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Natural Rulers

SUPPOSE you were landed in a new country or on another planet abounding in natural resources, but the inhabitants of which were living in the most primitive fashion.

You could tell them of the civilization from which you came, of the control that mankind has attained over pestilence and famine and disease, of the structures that man builds, how he motors over the earth, navigates the waters and flies through the air, talks across continents and oceans, produces all the comforts and culture of modern life so cheaply that all can participate in them.

But when they said, "Here is ore and fuel and lumber and workmen, everything in the way of labor and material that changed your wilderness into cities, your jungles into cultured homes; take the command and lead us to it," how far could you go?

The complexity of modern life is such that one man can be master of but a limited phase of it; and much of it must be spent in education and preparation in order that one may live it in its fullness, even having most of it made for him.

The average man can be taught to play his part, but comparatively few have the breadth of knowledge and the grasp of detail necessary to direct operations, to show the people of the undeveloped planet how to make and use steel and machinery and power and electricity, how to conduct the intricate processes of manufacture and exchange to develop the arts and sciences.

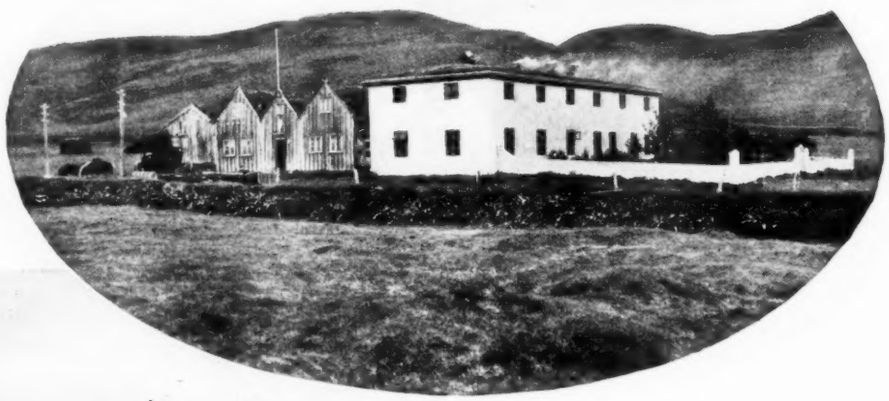
However high the plane of average literacy and intelligence may become, there will always be the leaders and the led, the managers and the managed, the generals and the privates.

To those who rule by reason of superior ability belong of right the power of direction, authority and emolument. Without such a ruling class the universal well-being cannot be maintained, and with it, so long as its prestige is exercised for the common good and not perverted to selfish ends, the masses can have no quarrel.

F. R. Low

Iceland, Where Hot Springs Give Building and Process Heat

Above — General appearance of country where Iceland's hot springs are located



Above—Modern farmstead, of the type now using hot springs heat

Above—Ancient type of Icelandic farm, as built since the first settlements

At right—Scene in Reykjavik, Iceland's modern capital

Heating Buildings with Hot Springs, Iceland's Substitute for Coal

By Earl Hanson
Fellow, American Geographical Society

OF THE three great hot spring districts in the world, New Zealand, Yellowstone Park and Iceland, the last-named has been longest known and least studied. Bunsen and others did some historic work on Geysir, the first known spouting well, which gave its name, slightly misspelled, to all similar phenomena throughout the world. But not until recently has systematic investigation of the enormous volcanic activity of Iceland begun and Icelanders become aware that in this volcanic activity lies an easy partial solution of their fuel problem.

Probably few farmers in the world are as badly off for fuel as the Icelanders have been for at least six centuries. Their country has no known coal deposits of commercial value. Long ago, the forest disappeared and the supply of wood was exhausted. Peat is found, but until recently there were no roads for its transportation. Coal has long been imported, but those who lived some distance from harbors could not afford to pack their fuel supply on ponies over narrow bridle paths.

The sole fuel resource of thousands of Icelanders has, for centuries, been sheep manure. This substance, packed on the floors of sheep barns during the winter, was removed in the spring, cut in blocks and stacked to dry. The following winter it was used as fuel. The supply was insufficient and also needed for fertilizer, and, consequently, tended to restrict the size of dwellings and encourage crowding.

During the last fifty years, however, Iceland has begun to modernize itself. Its cities and commerce have grown rapidly. Roads have been built and hundreds of automobiles imported. And it has suddenly been realized that the great stores of volcanic heat compensate for any lack of fuel resources.

On my first visit to Iceland in 1920, I heard that a few farmers had installed natural-hot-water heating systems in their houses. On my second visit, in 1927, I was given a copy of the Icelandic engineering journal (*Timarit Verkfracdingafjelags Islands*) containing an article that discussed the possibility of heating the whole city of Reykjavik with water from hot springs. In these few years the Icelanders had made great strides in the utilization of earth heat.

Two public buildings have recently been erected that are heated by hot springs, one more is under construction, and two will be built in the near future. The first is a trade school of wooden construction, near Husavik,

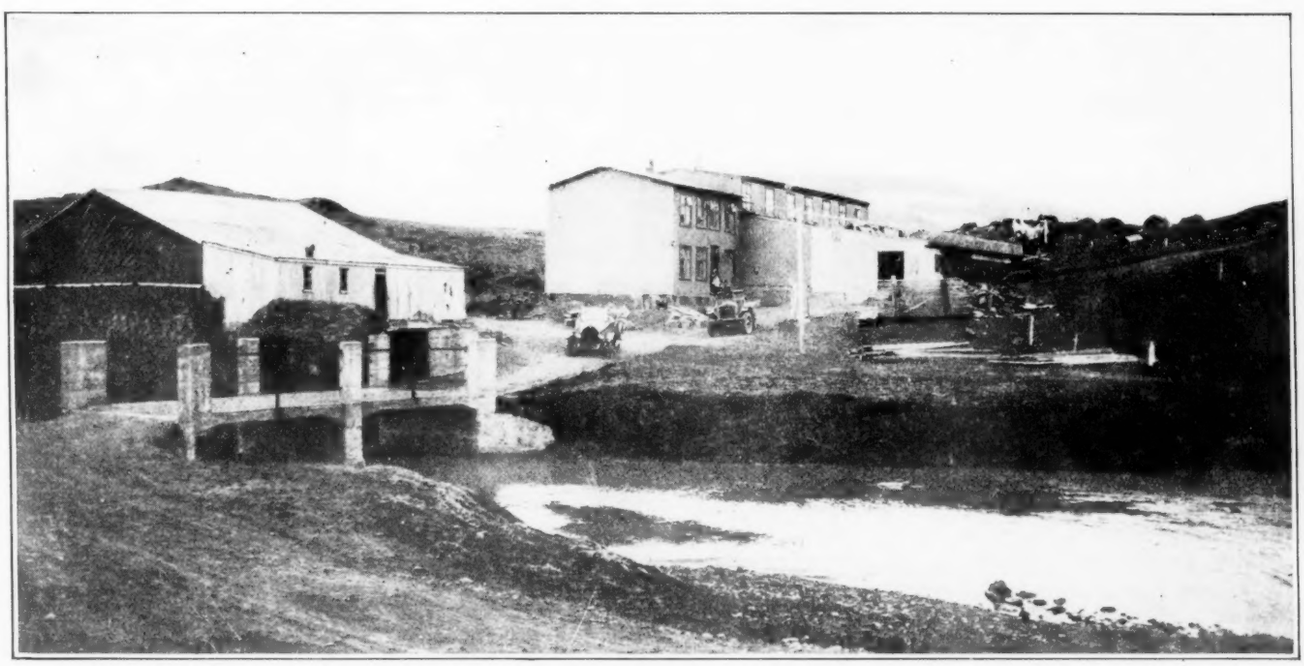


Fig. 1—Woolen mill in which the heating and the wool-drying are done by water from hot springs

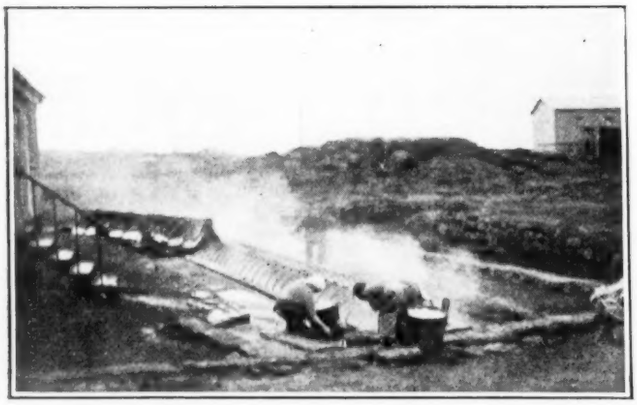


Fig. 2—Open-air laundry near Reykjavik, heated by water from hot springs

on the north coast. It is attended by some 60 pupils, about 50 living in the building. The heating system, which gives excellent results, uses water that flows by gravity from a spring on a hillside some hundred yards away. No information is available on the insulation of the pipe, but the temperature loss in transit is reported as only about 2 deg. F. The water, after heating the building, is discharged into the swimming pool with an average temperature of 122 deg. F., the temperature where the water enters the building being 133 deg. F. In connection with this temperature drop of only 11 deg., it should be stated that the Icelandic winter is not cold, the average temperature being higher, for instance, than that of Chicago in winter.

Another natural-heat installation is in the tuberculosis sanitarium near Kristness, in the northern part of the island. This building, housing 50 patients, is built of concrete with cork insulation in the walls. Water is pumped into the heating system with a temperature of 176 deg. F. at the springs and 167 deg. F. entering the building. The maximum flow is 28 gal. per min. No further details are available, except that the heating is entirely satisfactory in every kind of weather.

A small woolen mill near Reykjavik, manufacturing the coarse cloth known as *vadmal*, utilizes hot springs entirely for heating and for drying the product.

Hot Springs for House Heating

The use of hot springs for heating farmhouses is rapidly spreading. Technical details vary with conditions. Where large amounts of very hot water are available, radiators are unnecessary, single pipes being sufficient. Generally, the water from the spring is piped directly into the heating system, but where it is too alkaline or acid, a closed circuit system, with other water as the circulating medium, is used, the boiler being submerged in the spring.

Hooding volcanic steam vents and using the steam for heating, has been discussed but not tried. Most of the present private installations are of the gravity-flow type. Pumping seldom pays unless electric service is available.

In passing, it is interesting to note that several farmers who have no hot springs near their homes, have installed private hydro-electric plants for light, heat and cooking. A number of these have been described in the Icelandic periodical *Vaka*. They range in capacity from 2 to 9.5 kw. and in cost from $1,000 to $4,000. Most of these plants use vertical units of German manufacture, regulated by constant-voltage lamps, in place of governors. The waterwheels for two installations were built by the farmers themselves.

A building now under construction in Reykjavik that will be heated with natural hot water is the large national hospital. Also a school and a dormitory for the National University are being planned. For these buildings water will be pumped from a group of hot springs, a few miles outside the city, that have long been used to supply an open-air laundry and a municipal outdoor swimming pool.

A study of these springs was made by Benedikt Groendal, a young Icelandic engineer, and published in the *Timarit Verkfraedingafjelags Islands*, for November, 1926. Of the three springs available, the first is small in flow and has a temperature of but 105 deg. F. The second has a temperature of 167 deg. F. and a flow of 9.5 gal. per min. The third, with a temperature of 191 deg. F., delivers 166 gal. per min. Mr. Groendal studied the technical and economic possibilities of this supply for heating. The annual equivalent in coal of the water supply is about 1,840 tons, at over $10 per ton in Reykjavik. The first cost of installation between the springs and the building entrances is estimated at $23,000, using electric pumping equipment and wood-incased iron pipe. Operating costs plus 10 per cent interest and depreciation total $4,400 annually, exclusive of the heating systems within the various buildings. Compared with the equivalent coal cost, the hot springs show a net annual saving of over $14,000, or 62 per cent on the investment.

These springs are owned by the nation and are to be used only for municipal or national purposes. It is calculated that the hospital, school and dormitory will use only 75 per cent of the total heat, the remainder being available for some other purpose.

The problem of heating the whole city of Reykjavik with natural hot water is somewhat more complicated. The possibility of utilizing the nearest adequate hot springs, 24 miles from the city, has been discussed in a paper by Jon Thorlaksson, a leading Icelandic engineer and former prime minister of the country. These springs are sufficiently elevated to permit gravity flow. The water is boiling and sufficient to supply the 3,600 gal. per min. needed by Reykjavik at its present size. Mr. Thorlaksson discussed only technical possibilities and did not touch on the economic side.

Fig. 3—Swimming pool heated by same springs as laundry shown in Fig. 2

There is reason to believe, however, that it would be unnecessary to go 24 miles for an adequate supply of hot water. The springs at Laugarnes, less than two miles from Reykjavik, lie on a straight line of hot springs and of formations showing recent volcanic activity, which terminates, at its southern end, in the sulfataras and boiling mud-pots of Krisuvik. Natural steam has been obtained by drilling at Lardarello, Italy, and in the Tatio valley in Chile. There is no apparent reason why natural hot water cannot be obtained by drilling in certain parts of Iceland. This step has often been discussed by Icelandic engineers, but never attempted. At the present time available funds in Iceland are needed for other purposes, but the time of such investigations is not far off.

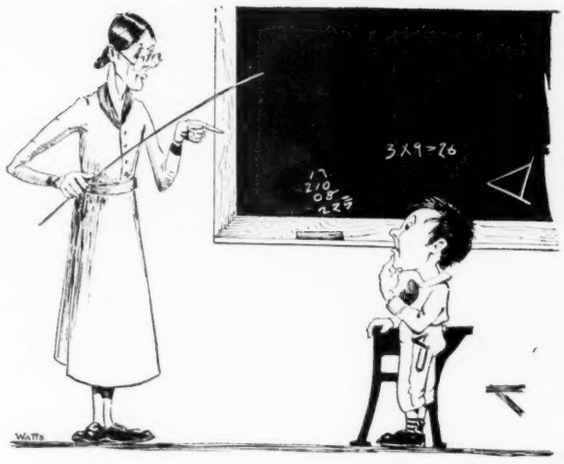
The idea of using hot springs for building heating is recent, but their use for certain other purposes, in isolated localities, dates back many centuries. They played a part in the introduction of Christianity in the year 1,000, when the heathen Icelanders specified baptism in warm water as one of the conditions of submitting peacefully to the new religion. They were used in outdoor baths in the Thirteenth Century. In several places simple huts, built over steam spouts or hot ground, provided popular steam and hot-air baths. Women have done their cooking in the springs for centuries, and bread baked by being buried near to a hot spring for 24 hours has long been popular.

What the springs will mean for the country in the future, when the inhabitants become fully aware of their possibilities, is beyond conjecture. The island has over 700 hot springs. They are situated at all altitudes and vary in characteristics over the whole gamut of temperature, flow and chemical analysis. Some, like Geysir, are strongly alkaline and deposit cones of limestone or the finest china clay. Others, like the sulfataras of Krisuvik, deposit large quantities of sublimated sulphur. Many contain varying amounts of radium and helium.

The springs are already being used somewhat in agriculture, for hothouses and irrigation. They can easily be used for drying fish, at present done expensively and laboriously by spreading in the sun and keeping watch for rain. Unlimited quantities of natural steam are available for any future industrial developments. And the matter of establishing health baths and making Iceland a health resort is only a question of time.

Whatever trend developments take, there is no doubt that Iceland, with more volcanic heat available than any other region in the world, will some day be one of the world's great testing grounds for the utilization of the earth's heat energy.

Fig. 4—National hospital at Reykjavik, to be heated by hot springs



What Do You Know?

By L. H. Morrison

The answers are on page 396

Ques. 1—To what hydrostatic pressure should an unfired pressure vessel built for 100 lb. working pressure with fusion welded joints be tested?

Ques. 2—Of what make were the first large American gas engines and where installed?

Ques. 3—Why is frozen carbon dioxide a good refrigerant for ice-cream packages, fish, etc., even though it costs more than water ice?

Ques. 4—What is the approximate cost of a horizontal tubular boiler based on the cost of a water-tube boiler of equal heating surface and equal working pressure?

Ques. 5—If the tops of three flyball governors are on the same level and if the governors make the same number of revolutions per minute, what will be the relative distance of the balls from the tops if on one governor the arms are 6 in. long, on the second 8 in. and on the third 10 in.?

Ques. 6—Why are not soft-rubber pump valves used with hot water?

Ques. 7—What is the difference between the low-heat and high-heat values of a fuel?

Ques. 8—Why should coal for a chain grate be not over $1\frac{1}{4}$ in. in diameter?

Ques. 9—In what way does a Hindley type worm and gear differ from the conventional type?

Ques. 10—If the load on a conductor is increased two times, how many times will the losses be increased?

At the Trenton Channel Plant of the Detroit Edison Company a coal-height indicator has been installed in each pulverizer coal bin to give an approximate check on coal levels. It consists of a 9-in. aluminum sphere, suspended by a small brass cable and counterweighted so as to rest normally just under the ceiling of the bin. It can be lowered by an operator and the coal level determined by the position of a pointer fastened to the counterweight, when the sphere reaches the coal in the bin.

Priming and Impurities in Feed Water

By Arthur W. Ewell
Professor of Physics, Worcester Polytechnic Institute

The experimental results described indicate that priming is increased by the presence of acids including hydrolized salts, non-dissociated substances such as sugar, slightly dissociated salts such as lead acetate, and insoluble oils. The increase in priming is attributed principally to increase in density and viscosity. Priming is decreased by insoluble solid particles and by highly dissociated salts. This decrease is attributed to the nucleii which such particles or ions furnish for the formation of vapor bubbles.

WHEN water boils, steam forms in bubbles beneath the surface. When these bubbles rise to the surface and burst, a certain amount of water is carried with the steam into the steam space. This is termed "priming." If a superheater is used, this water is evaporated. There is little of published experimental data respecting the influence of impurities on "priming." Neither steam engineers nor steam engineering manuals nor textbooks are in agreement respecting the effect upon priming of the different foreign materials that may be present in feed water. The importance of this question, particularly in marine practice, where sea water is often employed, occasioned the investigation here outlined. After considerable preliminary experimentation the apparatus illustrated was adopted. The capacity of the boiling flask up to the stopper was 2,150 c.c. A heating coil kept the temperature of the chamber in which the priming was investigated at about two degrees Centigrade below the boiling temperature. If the temperature had been kept at the boiling point for the particular day, a large amount of the water collected in the priming chamber might have been evaporated. If, for example, the current had been such as to give, without the passage of steam, a temperature slightly above the boiling point, the latent heat required for evaporation would have kept the temperature exactly at the boiling point and a large amount of priming water might have been evaporated without the experimenter's knowledge. Even though the temperature is kept two degrees below the boiling point, there will still be some evaporation. This, however, will introduce no error in comparative measurements since for the same time and the same jacket temperature the amount of evaporation will be the same. The heated jacket is essential, for otherwise a large amount of condensed steam will mask the relatively small amount of priming water. In these experiments there was practically no condensed steam to be considered.

The steam entered the top of the priming chamber and then passed through a plug of wire gauze which checked direct flow of the steam and retained any water carried along with the steam (priming water). The steam then escaped from the top of the other end of the chamber into the condenser. On account of evaporation from the graduate in which the condensed steam was collected, the amount read in the graduate was always less than the actual amount evaporated, as shown by the loss of weight of the boiling flask. At the close of a run the gauze was weighed together with a previously weighed wad of absorbent cotton which was used to collect the water, in the chamber, on the inside thermometer, on the stoppers and on the glass walls. Suitable precautions were taken during weighing, etc., to prevent evaporation. The thermometers were corrected for stem exposure and horizontal position. The following figures are illustrative of the readings in a typical experiment:

DISTILLED WATER. BAROMETER 73.89 CM. Hg.

Time	4.29	4.31	4.33	4.35	4.37	4.39
Outer Therm.	97.0	96.9	97.7	96.7	96.1	96.3
Inner Therm.	99.40	99.85	99.95	100.05	100.03	100.10
Graduate	0	40	75	115	165	210

Water evaporated, 219 grams. Rate of evaporation, 21.9 gr. per minute. Priming water collected, 1.87 gr. Priming per gram of water evaporated 0.0085 gr. = "Fractional Priming."

1 (a). Influence of common salt (sodium chloride): Average values of fractional priming for fourteen alternate experiments were:

Distilled water	6 per cent salt solution
0.0069 ± 0.0005	0.0053 ± 0.0005

(b) Strong salt solution—Average values of the fractional priming for six alternate experiments were:

Distilled water	14.85 per cent salt solution
0.0053	0.0051

It is evident that the addition of common salt decreases the amount of priming for low concentrations (6 per cent). For higher concentrations the priming is about the same as that for pure water.

2. Influence of potassium chloride—Average results for five alternate experiments:

Distilled water	6 per cent KCl solution
0.0055	0.0045

3. Influence of sugar—Six per cent solutions of sodium and potassium chloride are strongly dissociated. It appeared of interest to examine the effect of a dissolved substance which was not dissociated, and cane sugar was chosen. The following mean results were obtained for six alternate experiments:

Distilled water	5 per cent sugar solution
0.0049	0.0056

The addition of sugar, therefore, increases the amount of priming.

Is there any explanation for this difference between the effects of sugar and salt?

When a bubble of steam forms at the bottom of a boiler, it overcomes three pressures: One is the pressure of the steam above the water, which is, of course, transmitted through the water; another is the pressure due to the depth of water in the boiler; and the third is the pressure resulting from the attraction between the molecules, which manifests itself as "surface tension." When a bubble of steam forms, it must spread apart the neighboring water molecules. Electrical charges reduce the surface tension. A familiar application of this effect is the "capillary electrometer," an instrument found in nearly every physical laboratory. The presence of electrical charges should, therefore, facilitate the formation of bubbles.

It is well known that such is the case in the formation of clouds. If electrified particles are introduced into a chamber filled with water vapor, a cloud results immediately, each electrified particle acting as a nucleus for the formation of a water drop. A similar effect would naturally be expected in the case of boiling. If we introduce electrified particles, they would serve as nuclei and we would have a greater number of smaller bubbles, less violent boiling, and consequently less priming. This is what apparently happens in salt water. The majority of the molecules of salt in a weak solution break up into electrified particles, each molecule of salt giving an atom of sodium with a positive electrical charge and an atom of chlorine with a negative charge. We should find no such reduction in priming in a sugar solution, for sugar molecules do not break up into electrically charged particles.

The increase in priming with a sugar solution and lessened decrease in priming of salt water at high concentrations are undoubtedly due to the combined effect of greater weight of solutions compared with pure water, greater viscosity and slightly greater surface tension, all of which would tend toward more violent boiling and greater priming unless offset by some other factor, such as electrified particles.

If the foregoing explanation is correct, a salt that gives few electrified particles should increase priming because it increases the density, viscosity and surface tension. A 6 per cent solution of lead acetate has a much smaller number of molecules than a similar solution of sodium and potassium chloride, and few of these molecules are dissociated into electrified particles.

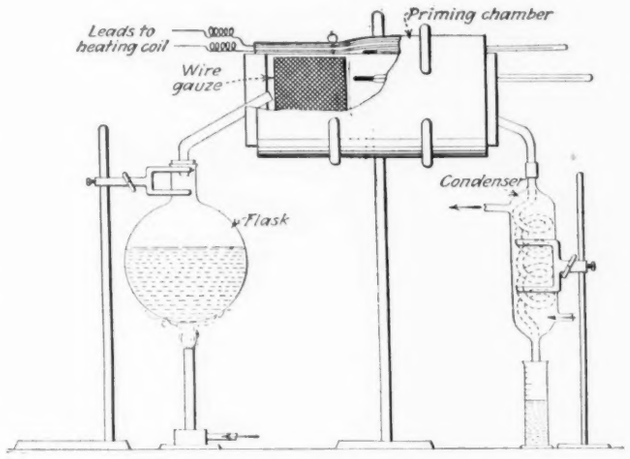
4. Average fractional priming with

Distilled water	6 per cent lead acetate
0.0040	0.0046

5. Bases such as sodium and potassium hydroxide give a large number of electrified particles in solution, but they also greatly increase the density and viscosity.

Base	Mean fractional priming with Distilled water	6 per cent solution
Sodium hydroxide	0.0054	0.0053
Potassium hydroxide	0.0037	0.0037

The foregoing results with sodium hydroxide were obtained with normal boiling, the rate of evaporation being about the same as with the salts and sugar (approximately 20 grams per minute). The result for potassium hydroxide and the corresponding result for water apply to *very* gentle boiling—the rate of evaporation being about one-tenth the normal rate. When boiling approached the customary rate, violent foaming appeared above the potassium hydroxide solution, making observations very difficult, but there was no doubt that this excessive foaming was accompanied by abnormally great priming.



Sketch of apparatus for determining amount of priming

6. Influences of Acids.

Acid	Mean fractional priming with Distilled water	6 per cent solution
Sulphuric	0.0046	0.0061
Hydrochloric	0.0050	0.0058
Magnesium chloride	0.0045	0.0069

Magnesium chloride is included because it largely hydrolyzes, giving a hydrochloric acid solution.

The foregoing solutions of strong acid are highly dissociated, resulting in a great number of electrified particles. One might conclude that the great increase in priming which they produce contradicts the foregoing explanation of the reduction in priming by weak solutions of sodium and potassium chloride. It should be remembered, however, that these acid solutions are peculiar. The large amount of heat liberated during solution indicates association between water and acid, and the boiling characteristics are entirely different from those of salt solutions, resembling more closely solutions of volatile liquids.

7. Influence of solid insoluble particles.

(a) 35 grams of powdered boiler scale were added to

1,720 c.c. of distilled water, and the average results for the fractional priming of nine alternate experiments were:

Distilled water	Water and scale
0.0064	0.0061

Apparently solid, insoluble particles slightly reduce priming, a result to be expected from the common laboratory practice of adding such material to boiling liquids in order to prevent violent ebulition ("bumping").

7 (b). The reduction in priming is more striking if the state of division is finer.

Suspension containing 6 grams of kaolin per liter. (Ten alternate experiments.)

Distilled water	Kaolin suspension
0.0050	0.0043

8. Influence of oil upon priming.

One cubic centimeter of medium machine oil was added to 1,720 c.c. of pure water in the boiling flask. The final mean results of twelve alternate experiments with pure water and pure water and oil were:

Pure water	0.0064
Water and oil	0.0068

This indicates that oil slightly increases the tendency to prime.

A Source for Help to the Plant Engineer

By W. Edward

THERE'S a saying, "It's not so much what you know that makes you of value to your fellowmen, as what you can find out and turn to good account." The saying is, perhaps, trite. Most everyone has heard it.

And yet, applied to the problems of the average plant engineer, there never was a saying more to the point. In fact, the plant engineer's work is of such great variance, contains so many factors that are of major importance in themselves, that the success of his administration is in almost direct proportion to the special knowledge that he can gather about himself from dependable outside sources.

Of all his problems there is none more important than that of power transmission. He may have no difficulty in choosing the sources of power from engine, motor, turbine; from industrial power plant or central station. He may have had the sources thrust upon him. But upon him alone is the responsibility for the choice and application of the equipment that must transmit power between source and point of application.

Perhaps he may choose belt or chain or gear or rope or coupling. If he installs them properly under conditions that permit of correct installation, he can count himself fortunate. If he can approach the problem with exact knowledge that he is making the best choice, he is indeed fortunate, for if ever there was a plant responsibility that has been a matter of opinion and guesswork, power transmission has been that problem.

All of which is a stage setting, so to speak, for the naming of a source of exact information on the subject that the plant engineer can have for the asking, a source that was just started about two years ago and that now is rapidly developing in the interest of mutual welfare of plant engineer and transmission equipment manufacturer.

The Power Transmission Association, with headquarters in Philadelphia, is this source. A brief description of the set-up and aims of this association will serve to point out its possibilities as a "load lifter" on one of the plant engineer's many vexing problems. It is a source of information to which he can go without obligation, a source from which he can secure unbiased engineering advice.

In the first place it should be understood that the association is not a philanthropic one. This is important because philanthropic advice on the plant engineer's duties is generally like having one's neighbor advise on the setting of one's automobile carburetor.

The members of the association, and at present there are 110, are made up of the manufacturers of the equipment in question, their salesmen and distributors. These members are all interested in selling their products, pulleys, hangers, gears, chain, belt, rope, speed reducers, couplings, lacing, dressing, accessories, and related items of power transmission equipment.

These manufacturers are constructively working together in their desire to sell, with the point in view of selling not on opinion nor high-pressure salesmanship, but on unbiased engineering data. In short they are conforming to one of Mr. Hoover's main objectives—elimination of waste in distribution by means of elimination of guesswork in choice of what to use.

To this end and to put their service to the engineer on an unbiased authoritative platform, they have formed what is known as the Engineers' Advisory Board.

This Board is composed of recognized plant engineers for the most part, men that are at present actively engaged in industry and that are representative through their connections with every type of industrial plant.

Suppose the engineer of a silk mill should desire advice on some particular transmission problem and should ask it of the Association.

There will be no wild scramble of salesmen to unload numerous pieces of equipment. What actually will happen is that the request will be transmitted to the chairman of the Engineers' Advisory Board. Back to the inquirer will come his answer secured by this chairman from silk mill engineer members of the Board who have met and solved such problems in the past.

The inquirer will have been able to shed one of his many worries with the knowledge that he has located a source of expert information. The association will have placed a transmission, from which there can come no trouble, the advisory engineers will, with the plant engineers, have come together on a ground of mutual helpfulness.

There are other activities in the association. Engineering data, for example, are to be sent out to the salesmen and distributors in the field. Every effort is being made to put these men in position to recommend correct initial drives, and further eliminate the guesswork in the distribution of equipment.

Engineers from the advisory board are available to make complete factory transmission layouts at a suitable fee.

The point of primary interest to the men in charge of plant and equipment at this time, however, is that down in Philadelphia is an outfit on which they can unload their specific problems in the power transmission game and, unloaded, can tackle the next of those many things that come to the desk of the plant engineer during the working day or to his phone at home in the middle of the night.

Power Developments *in the* South Mississippi States

High-pressure boilers are being installed in paper mills; Diesel units handle New Orleans storm water; light plants are being consolidated; small mills are buying power

By L. H. MORRISON
Editorial Staff of Power

THE average engineer's mental picture of those states bordering on the southern reaches of the Mississippi River is usually one of cotton fields, wide marshes and forests of pine, with no industrial activity. This picture fails by far to represent the real state of affairs. These states are alive with industrial development, and the proportional increase in the use of more efficient prime movers is greater than that of many other sections of the country.

In the mills and factories, old boilers are being removed to be replaced by high-pressure units. Condensing turbines are replacing worn-out non-condensing reciprocating steam engines, while the smaller plants are installing oil engines or purchasing power. The central stations are being consolidated into transmission systems, until an uninterrupted line stretches from Alabama across Mississippi into Louisiana and a second line extends from Louisiana to the far western edge of Texas.

In the sugar mills, which are of small capacity compared to Cuban installations, the burning of bagasse, or waste cane, is no longer followed. This material is baled and sold to the manufacturers of heat insulation sheeting, and oil is used for the mill fuel.

A few years ago lumber milling was the important manufacturing industry of Louisiana. The forests have disappeared and many mills have moved to the Pacific Coast. Of those still in operation, the Great Southern Mill at Bogalusa, La., has a large body of timber under the mill's ownership. Most of the mills that are still operating, have little incentive to install modern power equipment, as it is only a question of time before all the merchantable timber will disappear.

Some of the lumber mills have abandoned the burning of wood waste; instead, fuel oil or pulverized coal is used and the wood waste is converted into paper. Of the sawdust, which is not susceptible to transformation into paper, one enterprising lumber mill has made a floor-sweeping compound; when impregnated with oil and given an attractive color, the sawdust finds a ready market.

In the larger mills condensing operation is followed as a rule; turbines rather than reciprocating engines are the favorites. The Crossett Lumber Company's mill at Crossett, Ark. (Fig. 1), has an installed capacity of 3,000 kva. and is tied in with the transmission system of the Arkansas Power Company. Energy is interchanged, and the transmission company considers the lumber mill's entire power plant to be a reserve in case of trouble.

In the Great Southern Lumber Company's mill at Bogalusa, La., condensing turbines are used and the boilers are oil fired. The waste is conveyed about half a mile to the plant of the Bogalusa Paper Company. The paper mill had horizontal fire-tube boilers initially and used reciprocating engines exhausting at 5 lb. pressure into the driers. To increase paper production, the back pressure was increased to 35 lb. and a 2,500-kva.

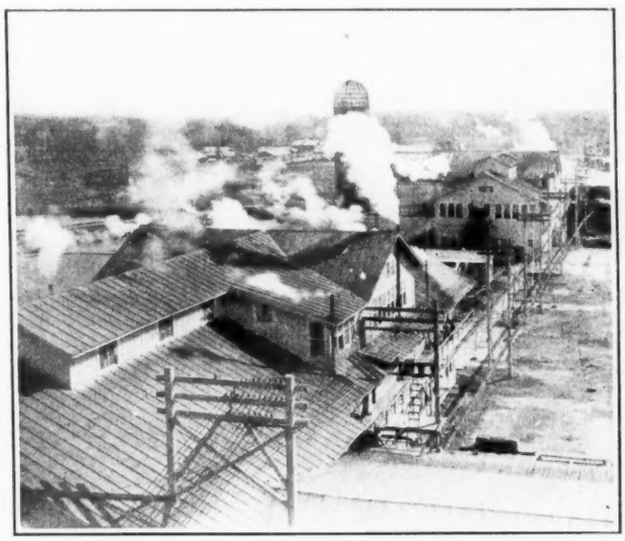
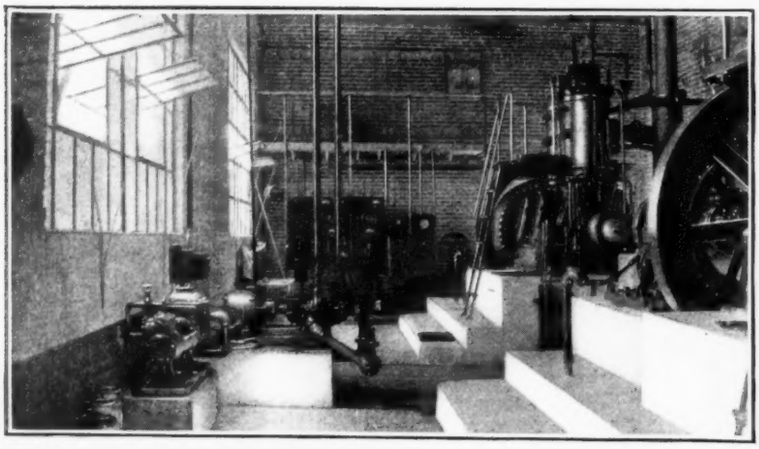


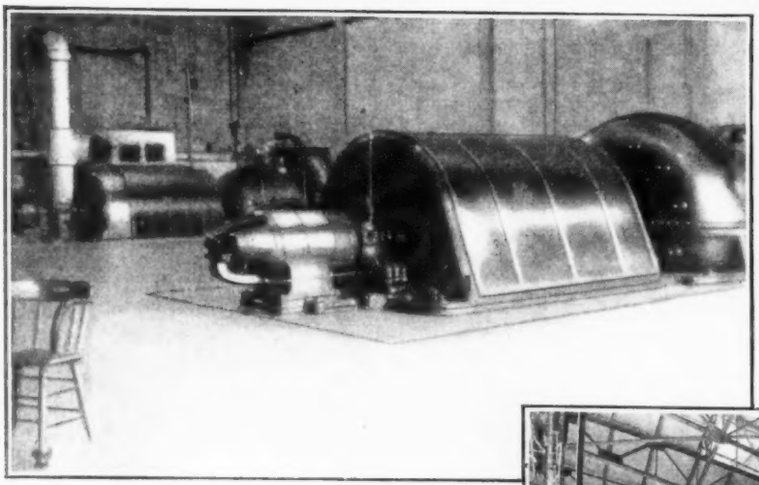
Fig. 1—Crossett Lumber Company's plant of 3,000 kw. capacity

bleeder-type and a 2,500-kva. mixed-flow turbine were installed, as were two 10,000-sq.ft. water-tube boilers. To permit the boilers to operate at a steady load, a steam accumulator was installed, which absorbed steam at 165 lb. and gave off 35 lb. pressure steam. The mill now has turned to higher pressures and has installed one, and will soon install a second 10,000-sq.ft. 400-lb. boiler. These boilers will be fired with pulverized coal and air preheaters will be used. The 400-lb. steam will go to a 7,500-kva. turbine and will be exhausted at 165 lb. into the main steam line. The present turbines will still be used, and it is hoped to obtain a favorable heat balance by the combination.

At the Brown Paper Company's mill, Monroe, La., a bleeder turbine has been installed, together with waste-heat boilers. This plant was described in *Power*. The turbine room is shown in Fig. 3.

The Southern International Paper Company will purchase energy for its new Camden, Ark., mill. Four 10,000-sq.ft. water-tube boilers have been installed to





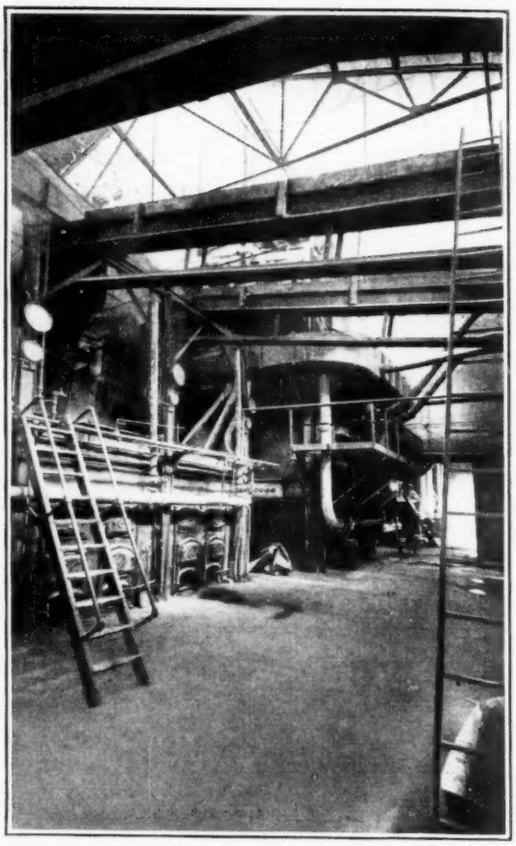
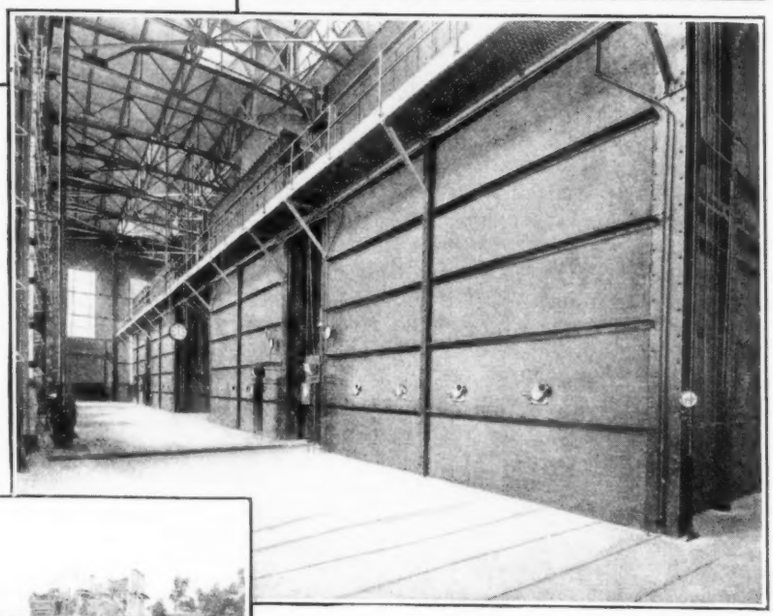


Fig. 2 (Top)—Oil engines in Slidell, La., ice and light plant

Fig. 3 (Above)—Turbines in Brown Paper Company's mill

Fig. 4 (Top Right)—Boilers of Bogalusa Paper Company



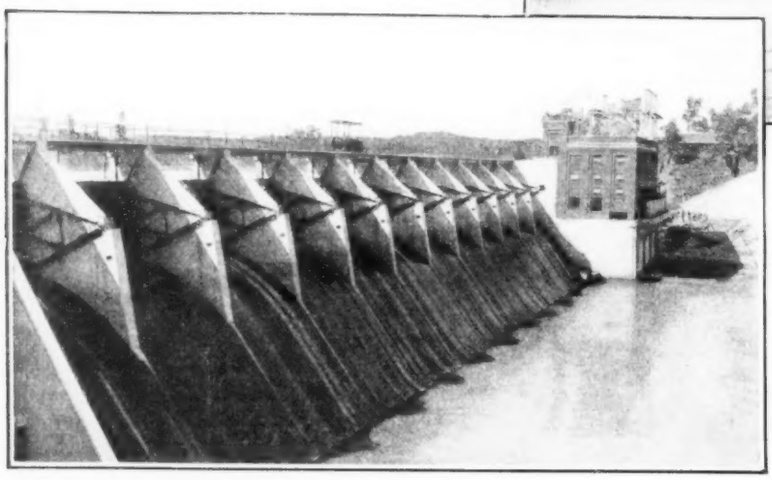


Fig. 5 (Above)—Gas-fired boilers in the Sterlington plant

Fig. 6 (Left)—Runnels hydro-electric development

supply steam to the digesters and driers. The power to operate the equipment is obtainable at a rate well under one cent per kilowatt-hour.

At Bastorp, La., excess power for the mill of the Southern International Paper Company was generated by natural-gas engines, but these have been shut down and energy is purchased from a transmission company.

Many ice plants in Mississippi, Louisiana and Arkansas are buying electrical energy. The same applies to hundreds of cotton gins formerly steam driven. Of the newer gins about 75 per cent are buying power, while 25 per cent have installed oil engines. Although the cotton gins operate only part of the year, electrical energy

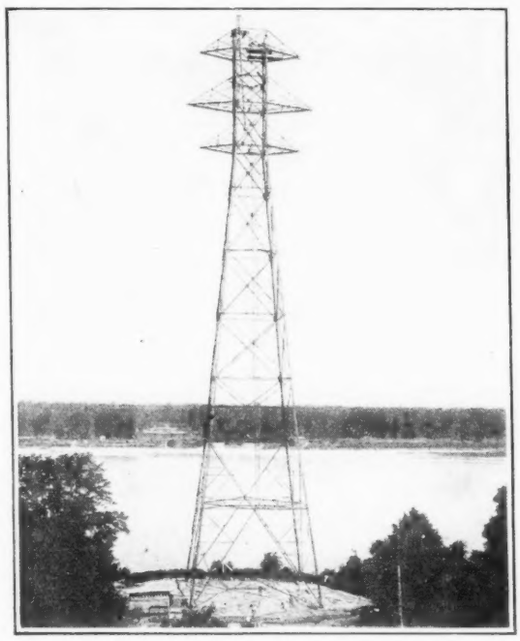


Fig. 7—Transmission line spanning the Mississippi River

is sold to them at a low price, the grounds being that the cotton-seed mills demand follows the closing of the gins and the system is always loaded.

New Orleans has installed three 400-hp. Diesel engines direct connected to centrifugal pumps to handle storm water. Another 1,000-hp. oil engine has been installed at Crowley, La., in the light plant. However, for the last two years no great increase in capacity of municipal lighting plants has been experienced. There is a marked drift toward the selling of isolated light plants to the large holding companies.

In Mississippi a number of small light plants, mostly those with oil engines, have been purchased by the Louisiana Utilities Company, but have not been shut down. One of these plants is shown in Fig. 4. In northern Louisiana and southern Arkansas many small plants have been purchased by the Louisiana Power Company and the Arkansas Power Company, which has connected the distribution lines to its transmission system.

The Louisiana Power Company operates a steam plant at Sterlington, La. This contains two 20,000-kva. turbines and a 40,000-kva. unit is now being installed. Part of the boilers are shown in Fig. 5. Natural gas, obtained at a low cost, is the fuel. In this plant neither economizers nor air preheaters have been installed, for the fuel is too cheap to justify the expense. This plant not only serves the Louisiana Power Company, but also is tied in with the plants of the Arkansas Power Company, an associated corporation. The Arkansas company has several hydro-electric installations, among them the Runnels Plant on the Ouachita River, shown in Fig. 5. Ultimately, there will be three dams and plants on this stream with a maximum capacity of 100,000 kw. The system extends into the Mississippi and is being connected to the lines of the Alabama Power Company. One of the towers carrying the line across the Mississippi River is shown in Fig. 7.

In the western parts of Louisiana and Arkansas most of the towns are supplied with power by the Southwestern Gas & Electric Company, whose main plant of 30,000 kva. is at Shreveport, La. This system is interconnected with the lines of the Texas Power Line.

Indications are that most of the small industries will purchase energy where it is available or until power rates are adjusted upward. Other such industries are installing and will continue to install oil engines. Large industrial plants find that they can generate power cheaper than it can be purchased, save under exceptional circumstances. Pressure in new boilers will be much higher than are used at present.

Servicing Pressure Tanks on Hydraulic Elevators

By A. M. Mead

IT HAS been my experience that pressure tanks on hydraulic elevators are likely to be neglected. The idea seems to prevail that there is no danger from these tanks failing. However, the water in them is subjected to high pressure air, and should the tank fail, the expansion of the air may cause serious results. Another objectionable feature about these installations, that is sometimes practiced, is the use of the pressure tank as a manifold to which several elevators are connected.

Formations like barnacles develop on the inside of the tanks. When these are removed, it will be found that a pit exists under them. I have seen these pits so close together that the surface of the metal had the appearance of a piece of tripe. These formations have a tendency to develop at the water line more than at other parts of the surface.

Adhering to a few simple rules will greatly extend the life of these tanks. Avoid vertical tanks, if possible, and secure the necessary capacity by using as small a diameter as is consistent with conditions. Only two openings for water flow should be made to the tank, one for the pump discharge and the other to the elevator service connection from the tank should lead to a manifold to which the various connections are made. The connections should be made to the tank so as to obtain a good circulation of the water. The tank should be thoroughly cleaned at least once a year and then dried, after which the surfaces should be given a good coat of paint. Care is something that these tanks generally lack more than anything else. A little more attention to the inside and outside surface would prevent some of the uncertainty that not infrequently exists with regard to their safety.

ELECTRICAL *Operation and Maintenance*

Avoid Trouble by

Keeping Equipment Clean

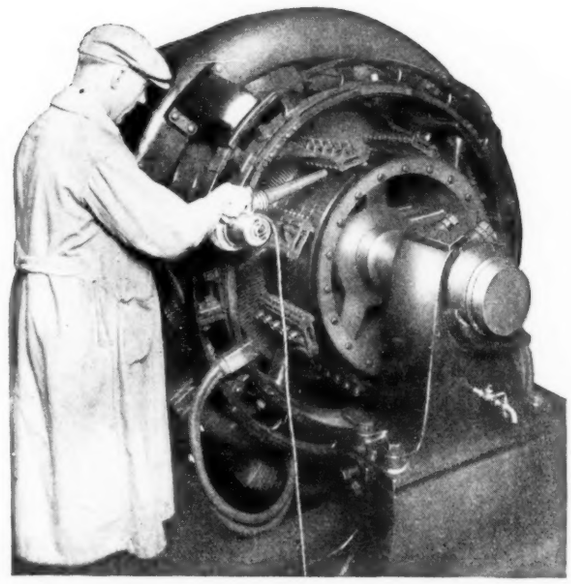


Fig. 1—Blower and vacuum cleaner removes dust from machines

By H. E. STAFFORD
Electrical Engineer, Provincial Paper Limited, Port Arthur, Ontario

THERE is an old saying that cleanliness is next to Godliness, and this saying was never more true than when applied to electrical equipment. Dirt of any kind is not only injurious to electrical equipment, but is the direct cause of operating failures, even if the equipment is not damaged.

Dust is always present in every manufacturing plant, and it requires constant vigilance to combat it. In grain elevators, flour mills, coal-handling plants, cement mills and other plants of a like nature, it is possible to collect a great deal of the dust by means of suction dust collectors. While the use of this type of equipment helps to a certain extent, there is a considerable amount of dust that gets into electrical equipment which the collector cannot touch.

One of the worst effects of dust in the industries mentioned, is to choke the air ducts in the laminations of motors, fill up the air gaps between stator and rotor and collect on the contacts of controllers, switches, etc., that are not made absolutely dustproof. If all motors were totally inclosed and the starting equipment absolutely dustproof, the cost of maintenance would be reduced to a minimum, but owing to the cost of this type of equipment and the extra space required, few manufacturing plants are so equipped. A totally inclosed motor, without forced ventilation, of a given size and rating is approximately twice the size of the semi-inclosed type and will cost as much as three times that of ordinary equipment, including the cost of dustproof control. There are now on the market several improved types of inclosed motors, the dimensions of which are not much greater than those of the semi-inclosed types. Totally inclosed motors of the old type were limited to about 30-hp. capacity and less, on account of the difficulty of dissipating the heat from the windings through the motor's shell. These limitations have been removed in the new designs.

Anti-Friction Bearings Recommended

From the viewpoint of cleanliness and lubrication it is safe to say that if every motor was equipped with anti-friction bearings, the number of failures due to bearing troubles would be greatly reduced. Ball bearings are so housed that it is impossible for dust or dirt to get into the lubricant, and the lubricant seldom gets onto the windings. Not so, however, with the old type of sleeve bearings. With this type of bearing, unless extreme care is taken when oiling, any excess oil is drawn onto the windings by the air current caused by the fan action of the rotor.

Again, if the bearings are not properly fitted, oil will siphon out and be drawn to the windings. One way of preventing this from happening is to cut a groove near the ends of the bearing so that the oil will be led back into the oil well through holes *A*, Fig. 3. In addition, felt washers should be fitted over the shaft and fastened to the housing, as shown in the figure.

Oil has the effect of softening the insulation and soaking into the winding, and although it is an insulator it opens up the insulation so that moisture and dirt can enter. Dust mingling with oil on the windings forms a paste and does not allow the heat generated in the

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windings to be dissipated, and is therefore the cause of a good many motor burn-outs.

When lubricating a bearing, the overflow should always be examined to see if the passage is open. Cases can be cited where no oil was visible in the overflow when the bearing was full. Never allow the overflow to become totally filled, as there will be plenty of oil in the chamber to be picked up by the rings if they are working properly even when the oil is one-quarter inch below the top of the overflow.

If a sleeve bearing motor is giving considerable trouble owing to dirt getting into the lubricant, the best and cheapest remedy is to purchase new end bells and have them fitted with ball or roller bearings. I have in mind a case where for six months sleeve bearings were being changed at the rate of two every three weeks, owing to the effects of dust, notwithstanding the fact that the bearings were washed out every other day and refilled with fresh lubricant. When new end bells equipped with ball bearings were installed, no more bearing trouble developed, although three years have elapsed since the change was made.

All motors and other electrical equipment should be cleaned periodically, the time between cleaning periods being determined by the amount of dirt collected. On certain applications where the dust is fine, it may be collected by vacuum. There are several types of vacuum cleaners on the markets. One good feature about

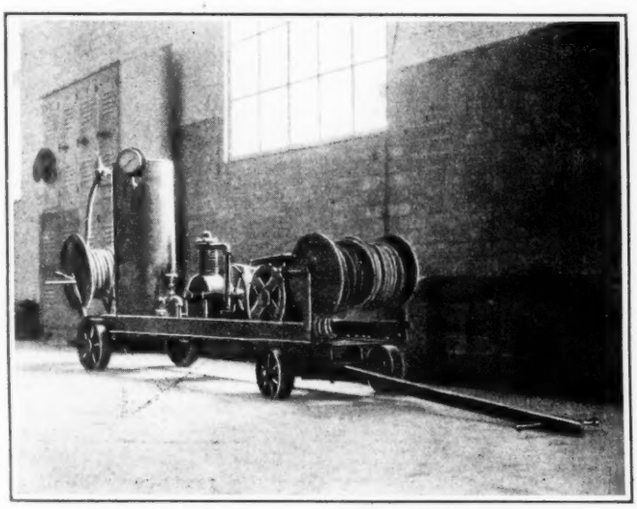

Fig. 2—Portable air compressor used for cleaning electrical equipment

cleaning by vacuum is that the dust is not blown from one place to be deposited in another. There are certain applications where vacuum cannot be used to advantage, such as where the windings are covered with wood pulp and certain other substances, the adhesion being too great. In cases of this kind compressed air is recommended.

Caution is required in the use of compressed air, since it always contains moisture. It should never be used in removing dust from commutators, and neither should high pressures be used on any winding. While it can be used to dislodge nearly all the dirt, experience has shown that after a machine has been blown from all possible angles and no more dirt is in evidence, considerable may be blown from the laminations and through the air ducts when the machine is started, by the machine's

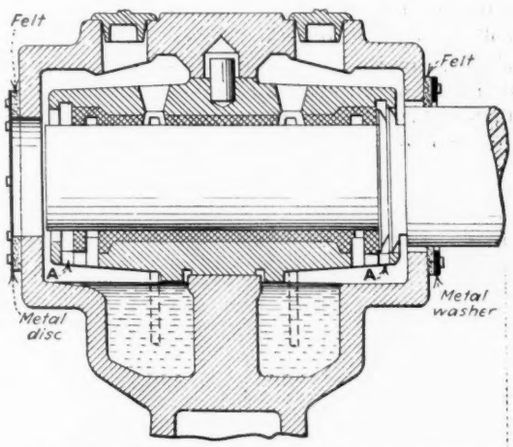

Fig. 3—Felt washers used to keep dirt out and oil in the bearing

ventilating system. A good many industrial plants have compressed air and some also have vacuum systems piped to the equipment, where it is possible to use either. There are several portable air compressors on the market somewhat similar to the one shown in Fig. 2. The compressor is home-made and consists of a 5-hp. motor, a 4x4-in. compressor, a tank three feet high by twelve inches diameter, 150 ft. of ½-in. air hose and 250 ft. of power cable. The hose and cable are wound on reels on the truck. Pressures above 100 lb. are not recommended where compressed air is used, since there is a liability of damage to the windings.

In cleaning a commutator after undercutting and if vacuum is not available, a hand bellows or a small portable blower, shown in Fig. 1, should be used. A blower of this type can also be used as a suction cleaner and can be used for general cleaning purposes.

Chart for Solving Alternating Current Problem*

By C. Albert Kulmann

When dealing with power transmitted in an alternating-current circuit, there are four elements involved: Real kilowatts, the energy component of the load; reactive kilovolt-amperes, which is generally a magnetizing component and is at right angles to the power component; the kilovolt-ampere load on the system, which is the resultant of the power and reactive

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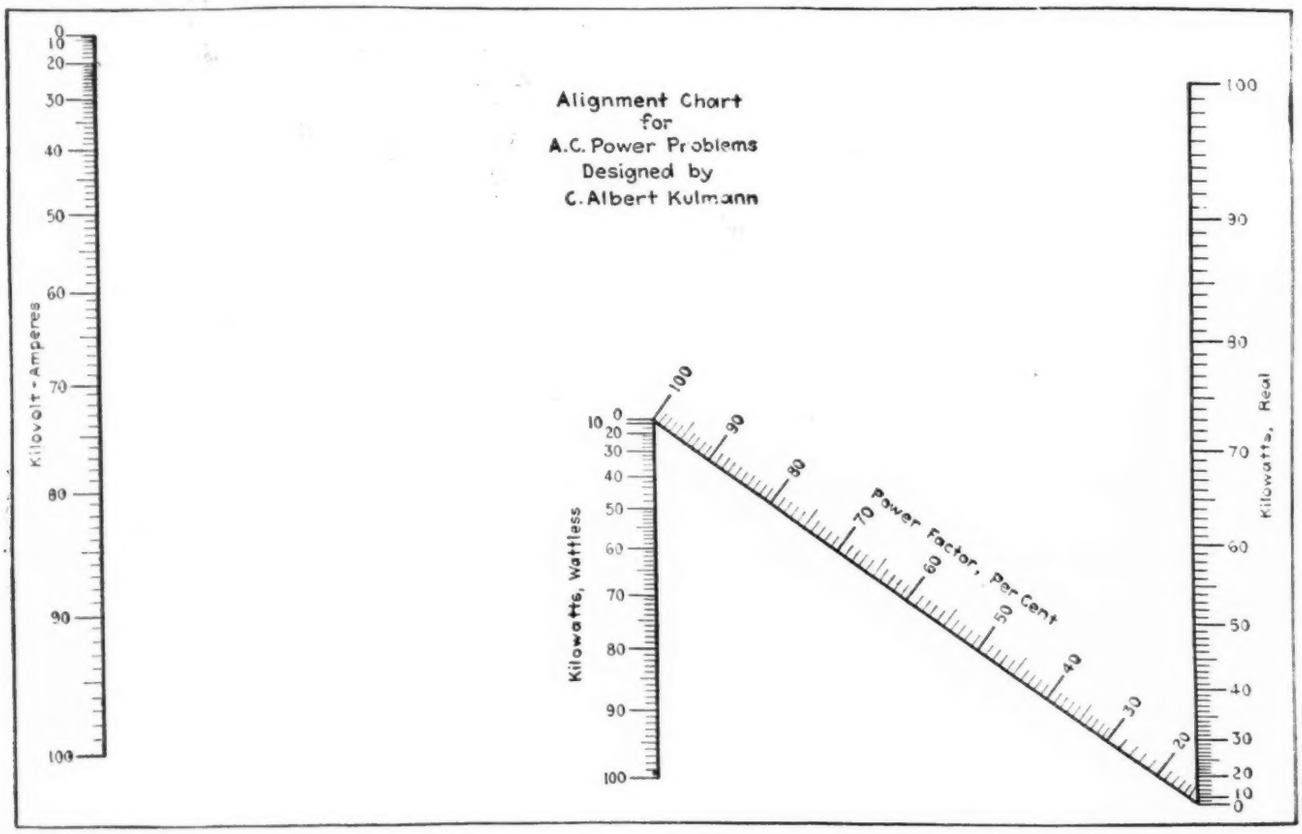
components; and the power factor, which equals the power component (wattmeter reading) divided by the kilovolt-amperes.

The kilovolt-amperes in a single-phase circuit is equal to the voltmeter reading times the ammeter reading. In a balanced two-phase circuit kilovolt-amperes equals the voltmeter reading times the ammeter reading times two. For a balanced three-phase circuit kilovolt-amperes equals volts times amperes times 1.732.

The chart provides an easy means of obtaining any of the related values, power factor, kilowatts, reactive kilovolts-amperes (wattless kilowatts) and kilovolt-amperes, when any two of the values are known. In using the chart, lay a straight-edge to connect the two scale points for the two known values and read the other two values on the proper scales.



For example, in a three-phase circuit, with the voltmeter reading 440, the ammeter reading 75 and the wattmeter reading 45 kilowatts, the kilovolt-amperes equals $(440 \times 75 \times 1.732) \div 1{,}000 = 57.156$, say 57. To determine the power factor and reactive component, lay a straight-edge from 45 on the kilowatt scale to 57 on the kilovolt-ampere scale and read the per cent power factor, 80, on the power-factor scale and the reactive kilovolt-amperes, 35, on the kilowatt-wattless scale.

Assume the wattmeter reading is 80 kilowatts and the power factor meter reading 85. To find the kilovolt-ampere load and the reactive kilovolt-amperes, lay the straight-edge from 80 on the kilowatt scale though 85 on the power-factor scale and read kilovolt-amperes, 94, and reactive kilovolt-ampere, 50, on their respective scales.

When one or more known values lie beyond the range of the scales, they may be brought onto the scales by the use of a common multiplier for all values except that of power factor. For instance, if a circuit load is 160 kva. and the wattmeter reading is 96 kw., use scale values of 80 and 48, respectively. The power factor indicated, 60 per cent, is the correct value, no conversion being necessary, but the indicated value of reactive kilovolt-amperes, 64, must be multiplied by two, since the other values are double the scale value used, and the reactive kilovolt-amperes is $64 \times 2 = 128$.

Take another example where the wattmeter reading is 250 kw. and the power factor 70. To bring 250 kw. on the scale, divide by 5, which gives 50. Place the straight-edge from 50 on the kilowatt scale through 70 on the power-factor scale and read 71.5 on the kilovolt-ampere scale and 51 on the kilowatt-wattless scale. To convert these into true values multiply by 5, which gives 357.5 kilovolt-amperes and 255 reactive kilovolt-amperes.

In practice, the reactive component (kilowatts wattless) is generally the least important of the four elements. The kilowatts, which is the wattmeter reading, the kilovolt-ampere load on the system and the power factor are the elements in common use.

INTERNAL COMBUSTION ENGINES

Operating a Diesel Engine Above Sea Level

By R. E. Hathsteiner

LIGHT, power and ice are supplied to Lordsburgh, N.M., by the Texas-Louisiana Power Company. While the power plant building is not at all pretentious, nevertheless it houses a Diesel unit that has given satisfactory operating results and has shown great reliability as well as economy of both fuel and lubricating oil. The original plant contained a six-ton ice plant, with two vertical, open-type ammonia compressors, and two 100-hp. horizontal two-stroke-cycle semi-Diesel engines belted to alternating-current generators. An increase in the station load, together with the fact that the two old engines were wearing out and were giving considerable trouble, made it imperative that a new generating unit be installed, and late in the year 1925 an order was placed for a 200-hp. Diesel. The new unit, which is illustrated in Figs. 1 and 3, is a three-cylinder, vertical, De La Vergne solid-injection engine, with cylinder dimensions 14½x18 in. and has a sea-level rating of 200 hp. at 277 r.p.m. The engine is direct connected to a 156-kva. three-phase 60-cycle 2,300-volt General Electric generator, and has a direct-connected 7½-kw. exciter. At the elevation of Lordsburg, 4,300 ft., and using a generator efficiency of 90 per cent, the unit is conservatively rated at 115 kw., a reduction of 3 per cent per 1,000 ft. elevation being made from the indicated horsepower developed at sea level.

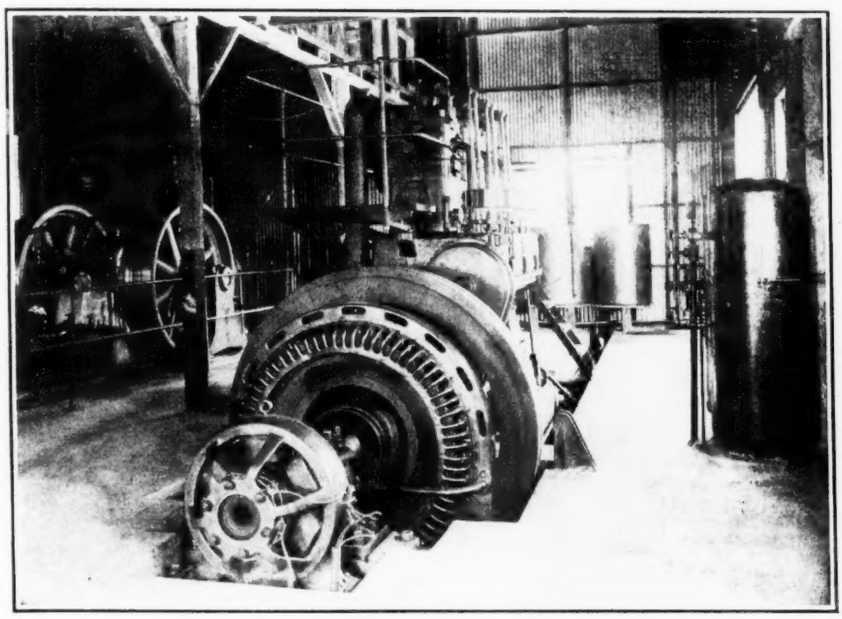


Fig. 1—The Lordsburgh Diesel with old semi-Diesel in background

Since there is no domestic gas in Lordsburgh, and in view of the high price of coal of any kind, the sale of electric cooking ranges has been marked. In a town of only 1,800 people, at least half to three-quarters of whom are Mexicans of the laboring class, the plant has more than 40 electric ranges connected, besides many electric refrigerators hot-water heaters, washing machines and other electrical appliances. So that in spite of the fact that there is no large power load, the average load is fairly high, with three peaks during the day at meal times, the load in the morning being almost as heavy as during the evening peak, which at times swings to 125 kw. As in most central stations, however, the very light after midnight load brings the average load factor down to about 40 per cent. In spite of the low average load factor and the overload the Diesel is often forced to carry during the peak periods, a monthly station average of about 8 kw.-hr. is obtained from each gallon of 25-deg. Baumé California fuel oil. This record would be better if it were not for the poor economy of the two old engines which are used occasionally.

The lubricating system is particularly worthy of note, because of its simplicity and reliability. The system is of the recirculating, forced-feed type, with a constant pressure obtained from an overhead supply tank which may be seen in the upper right-hand corner of Fig. 1. The

INTERNAL COMBUSTION *Engines*

elevated tank gives a positive, constant gravity head, and from this tank the oil flows to a lubricating oil header on the rear of the engine. From this header the oil is conducted to each main bearing through a connection of liberal size, and from the main bearings the oil flows through the hollow drilled crankshaft to the crankpins, and thence through the hollow drilled connecting rods up

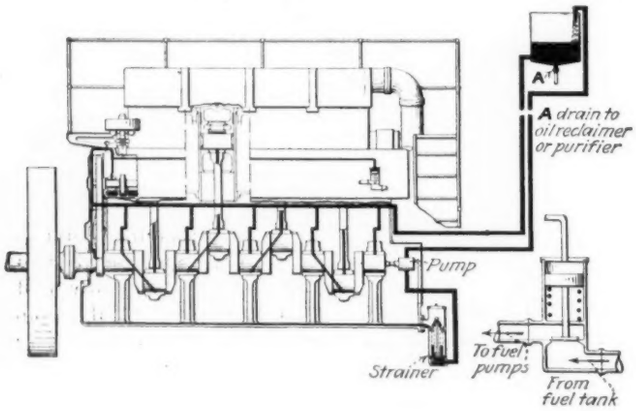


Fig. 2—The lubricating system and the automatic fuel control valve

to the wristpins. Other lines carry the lubricating oil to jets over the camshaft gear drive and other points, so that the engine is completely lubricated by the gravity force-feed system, and the only parts that must be hand-oiled are the governor spindle and the valve tappets.

The lubricating oil falls from the various bearings, cylinder walls, etc., back into the deep crankcase, the bottom of which has a slight pitch toward one end so that the oil will drain promptly into a sump containing a strainer, from which point a small pump, driven directly off of the end of the engine crankshaft, picks up the filtered oil and forces it back into the overhead tank.

It is to be noted that the function of this pump is simply to return the oil to the overhead tank, and even if this pump were to fail, the engine would continue to be supplied with an abundance of lubricating oil from the overhead tank in the usual manner, and the filtered oil could be returned to the tank by a small, hand-operated oscillating pump which is connected into the return line for such emergencies, and for filling the system with new oil.

A feature of the lubricating system is the automatic engine stop, which operates in case of a failure of the lubricating oil supply. This valve is frequently called the "sleeper-valve," because it will function and save the engine even if the man on shift is asleep on the job. It consists of a small valve in the fuel-oil supply line, which is held open by the pressure in the lubricating oil system; and should the lubricating oil pressure fail for any reason, the fuel is immediately shut off and the engine stops. This is shown in Fig. 2. Regardless of how careful an engine-room crew may be, it is almost a certainty that some day for some reason there will be a failure of the lubricating oil supply, and it is interesting to note that in practically every case where one of these safety stops has been installed, it has functioned at least once and saved the engine from possible serious injury, often when the engine was new and the engineer tried to start the engine without first turning on the lubricating oil supply; or even in older installations where, in the hurry of getting another engine on the line, someone forgot to open the lubricating oil supply and the engine refused to start.

In the central background in Fig. 1 may be seen the oil reclaimer for cleaning the lubricating oil. Periodically, a batch of dirty oil is drawn from the overhead supply tank, into the reclaimer, which operates on the precipitation principle.

From the reclaimer, which is the left-hand tank, the clean oil flows to the clean oil storage tank on the right, from which it may either be pumped directly back into the engine circulating system, or drawn off at a spigot for use around the plant.

The consumption of lubricating oil by the Diesel has been very low, in spite of the fact that *all* lubricating oil used around the plant, excepting ammonia oil, is charged against the engine. The two old horizontal engines burn a great deal of lubricating oil when they are run occasionally to help over a peak, or when the new unit is shut down for inspection and repairs. In spite of this penalization the average for the first eight

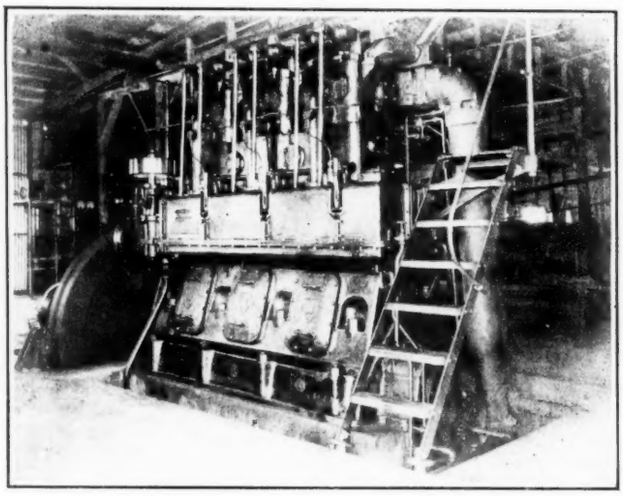


Fig. 3—This shows the exhaust line and the air charging device

months in 1927 was 7,700 rated horsepower-hours per gallon of new lubricating oil added to the system.

The reliability of the lubricating system is evidenced by the fact that they have never experienced a hot bearing on this engine during the period of two years that it has been in continuous 24-hour service.

Since the engine is of the solid-injection type, of course there is no high-pressure air compressor on the engine, and in order to obtain compressed air for starting the engine, a small, water-cooled check valve is used, which allows a part of the air and gases from No. 3

INTERNAL COMBUSTION *Engines*

cylinder to be forced into the starting-air bottles, during the compression and firing stroke. This small check assembly may be seen in Fig. 3 just below the exhaust elbow and is also shown in detail in Fig. 5. It will be noted that it is compact, simple and out of the way, and yet furnishes the requisite starting air in an inexpensive manner. A small gasoline-engine-driven compressor set

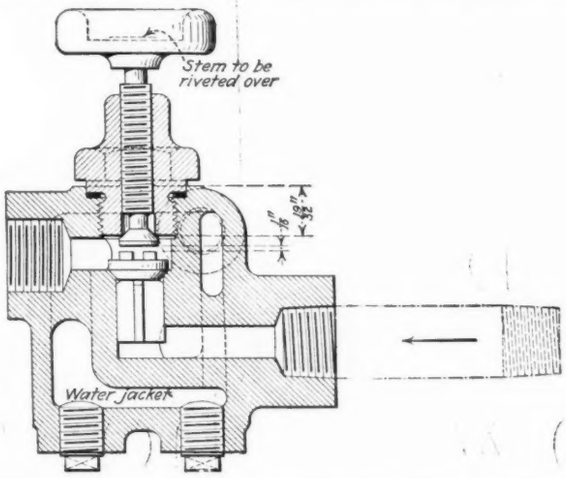


Fig. 4—Cross-section of the air tank charging valve

is installed for use in the event that the air charge is accidentally lost, but so far this has not happened.

The fuel oil supply system is also conveniently arranged. While various grades of fuel oil have been used with entire success, ranging from very heavy to fairly light, the fuel at present being used is 25 deg. Baumé California fuel oil, which flows freely and is quite clean and free from dirt and suspended matter.

The oil is unloaded from tank cars into an underground storage tank, from which it is drawn by a motor-driven transfer pump and placed in an overhead graduated fuel oil supply tank. By having this tank calibrated, an hourly check may be made on the consumption of fuel oil.

From this overhead supply tank the fuel oil flows by gravity to a float controlled standpipe box on the engine itself, and the three fuel injection pumps, one for each cylinder, take their suctions from this standpipe box.

The fuel pumps are of the fixed or constant stroke type, delivering a constant amount of fuel oil, and governing is accomplished by opening a bypass or relief valve near the end of the stroke, thus allowing some of the fuel to return to the standpipe box. The governor simply controls the point at which the relief valves are opened, and the duty required of the governor is not very heavy, which results in a quick response to sudden changes in the load. For example, this particular engine is frequently hit by a 45-hp. induction motor driving a cinder hoist in the local railroad yards, and a 30-hp. motor at the city pumping plant, and although this combined load is a large percentage of the engine capacity, the effect is hardly noticeable.

The item of repairs is often a considerable one, but in this plant the amount of repair work has been almost negligible.

The principal item was the replacement of several of the copper fuel oil lines which began to leak when the strainers at the spray nozzles suddenly became clogged with dirt, causing excessive pressure in the lines.

It has also been necessary to put new copper obturators or "cup washers" on the plungers of the injection pumps as they were worn away. These obturators serve the same purpose as a cup leather in an old-fashioned pump.

To date, it has not been necessary to do any work on the main bearings and only a very small amount of wear has been noticeable on the crankpin boxes. Only a few weeks ago a piston and rod were pulled for the first time in more than a year, and the wristpin box was tightened. When convenient, the other two pistons will be pulled to check up on the wrist boxes.

Long continuous runs are the rule, and on several occasions the engine has been run continuously for three months before it was shut down for inspection.

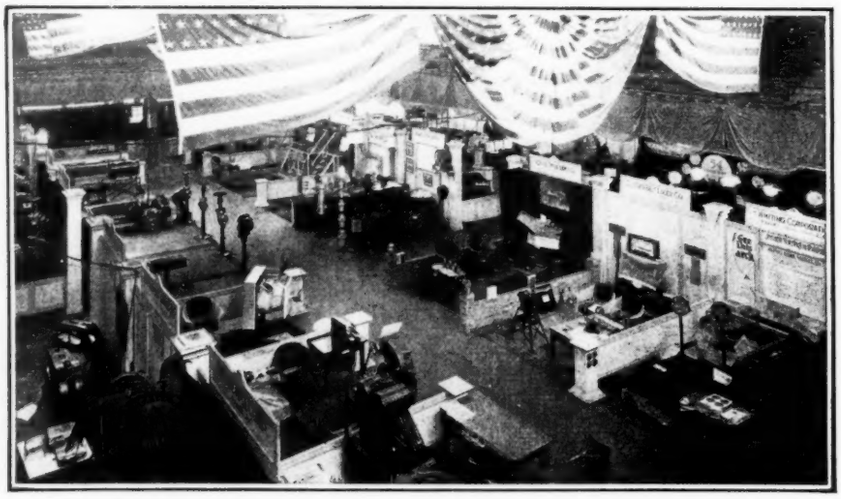
The day engineer takes care of minor repairs and at the same time pulls two tons of ice. The two night men pull two tons of ice on their shifts, in addition to running the plant.

A New Scott-Still Motor Ship

ACCORDING to *The Engineer* Scott's Shipbuilding & Engineering Company, Ltd., of Greenock, has launched the motor ship "Eurybates," a vessel of 6,400 tons gross, built for the Ocean Steamship Company, of Liverpool. This vessel, like the same owner's 5,994-ton twin-screw motor ship "Dolius," which has now satisfactorily completed over 200,000 miles in her 3½ years' service, will be propelled by Scott-Still engines.

The "Eurybates" will have two sets of engines, each of which will comprise five 27-in. diameter internal-combustion cylinders and two 24-in. steam cylinders, the stroke in all cases being 45 in. In the case of the "Dolius," it will be remembered, the regenerated steam was employed in the non-combustion ends of the combustion cylinders. That arrangement was claimed by Mr. Still to promote the efficiency of the cycles on both sides of the piston, and interest therefore attaches to the fact that in the engines of the "Eurybates" this advantage is apparently being sacrificed by the adoption of separate cylinders for the two cycles.

The engines of the new vessel will develop a normal combined combustion and steam output of 5,000 b.hp. at a sea speed of 105 r.p.m. Two regenerator boilers will be provided, one of which will work under a pressure of 180 lb. and the other at 15 lb. Oil burners will be fitted to the larger boiler for generating steam by direct firing for maneuvering purposes. The exhaust steam from the engines will, as in the "Dolius," be used to drive turbine scavenge air blowers. The "Eurybates" is also of especial interest because of the fact that her hull has been built of high elastic limit steel, a fact which, it is said, will be responsible for an increase of more than 250 tons in her cargo-carrying capacity, as compared with a similar vessel built of ordinary material.

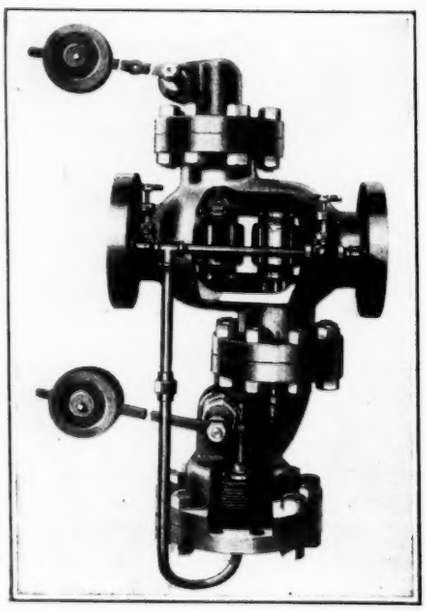


THIRD Midwest Power Show

THE third Midwest Power Show has come and gone, and an exposition at least the equal of its two predecessors has passed into history. To the visitor who is not primarily interested in the generation or utilization of steam, the impressions of the show will probably be short-lived, but to the progressive engineer who is interested in gathering new ideas, finding means of better utilizing his present equipment, or locating some accessory that will eliminate waste and make his plant more economical, the recent show should have proved of value.

With the rapid progress being made in the art of power-plant design, the high boiler ratings being obtained through the use of water-cooled furnace walls, the adoption of higher pressures with the resulting changes in boiler design, the recent improvements in coal pulverizers and stokers, the improvements in economizers and air preheaters, the adoption of mechanical or of electrical combustion control to increase boiler efficiencies further and the new developments in feed-water treatment, the Power Show afforded an unparalleled opportunity to the engineer to keep abreast of the latest developments.

With two hundred and sixty exhibitors occupying the entire floor space of the Coliseum the exposition pictured the latest in power plant equipment.



"Copes" combined regulator and valve

The recent show at Chicago was fairly representative and complete. Although a few of the larger and important manufacturers who had previously exhibited were absent, there were a sufficient number exhibiting the various types of equipment to present a true picture of the trend in power-plant practice

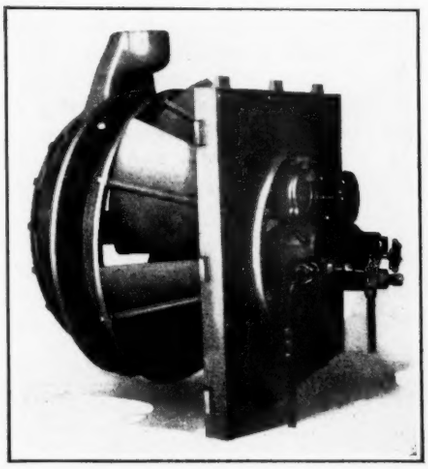
It could not be said that the exhibits as a whole were more attractively arranged than heretofore; in fact, some were lacking in this respect, owing to an attempt to crowd too much in a given space. On the other hand, many were exceptionally well arranged, so that each piece stood out prominently and invited inspection.

In the showing of new equipment, which has now become an important feature of every power exposition, the recent show at Chicago probably contributed more than either of the previous ones. The exhibits were not confined to any one particular line, but were fairly well distributed over the field, with the heating and ventilating division contributing its share.

Evidence that the manufacturers are doing their part to help along the smoke-abatement campaign which is under way in certain parts of the country, is seen in the fact that three new stokers, especially designed for heating boilers, ranging in capacities

from 150 to 2,000 sq.ft. of heating surface, were shown. One of these was of the overfeed type, while the other two were of the underfeed type, each being designed to give smokeless combustion when burning the poorer grades of bituminous coal.

The new stoker of the overfeed type is a recent development of the Joseph Harrington Stoker Company, Harvey, Ill. It is especially adapted to firebox and sectional boilers requiring coal feeds up to 500 lb. per hour or with a maximum capacity of 5,000 lb. of steam per hour. The stoker is built unusually strong with certain reciprocating parts made of cast steel. The driving parts are inclosed in oiltight dustproof housings,



Peabody insulated-front burner

and the fan for supplying the air and the motor for driving the complete unit are mounted on the top of the stoker frame. A special interlocking connection is provided between the coal and air supply so that the relation between the two will remain fixed with the variation in the load. Provision is also made to allow the use of natural draft at low ratings

One of the underfeed stokers was shown by the Auburn Stoker Company, Auburn, Ind. The unit is designed especially for installation under unusually low-set and internal firebox boilers, with little or no change in the present setting, as no ashpit is required.

The stoker, which is arranged to

—a well-balanced exhibit of recent developments

The exposition as seen from the south balcony of the Coliseum Photo by Kaufman & Fabry

be driven by either an electric or steam motor, employs a reciprocating ram to feed the fuel into the furnace and an independent motor-driven fan for supplying the forced draft. The fan can be connected in the front or at the rear as desired.

The other new stoker, designed for small boilers with capacities ranging from 500 to 2,500 lb. of steam per hour, was exhibited by the Modern Coal Burner Company, Chicago. It operates on the underfeed principle, the coal being fed from a hopper to the retort in the furnace by means of a screw. In the retort the coal is forced upward and outward over the grate and the air for combustion is admitted through openings in the side of the retort and made to flow through the thickest part of the fuel bed. The stoker is motor driven through a reduction gear, and the speed of the screw is readily changed to give any feed desired up to 300 lb. of coal per hour.

Recent developments in boiler construction to meet the demands for higher pressures were shown by a number of companies. In the exhibit of the Babcock & Wilcox Company, which was in conjunction with that of the Bailey Meter Company and the Fuller-Lehigh Company, a number of high-pressure boiler parts were shown, including a forged steel header for 1,400 lb. pressure and a forged steel superheater box. A section of a return-bend wrought-steel economizer, which is adaptable to steaming or non-steaming service and in which all joints are outside the path of the gases, was also shown. This economizer was described in the Aug. 30, 1927, issue of *Power*.

The Walsh & Weidner Boiler Company showed a longitudinal section of the latest type 54-in. steam drum for 450 lb. pressure with the heads shrunk on the outside of the ends of the shell instead of inside as is the usual practice. The section was fitted with the new W.-W. high-pressure water gage and manhole cover. This company also showed a section of its new furnace wall, which presents an entire water-cooled surface without the use of fins or wing plates. A recent improvement to this wall is the addition of a center support, or belly band, to prevent weaving of the tubes. This wall was described in the Sept. 20, 1927, issue of *Power*.

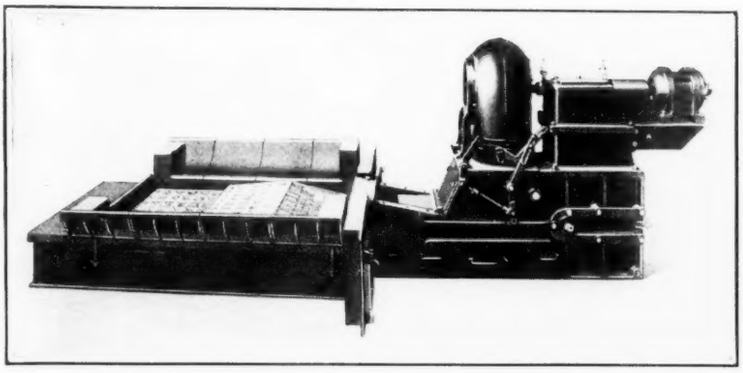
A new high-pressure sinuous header with round tube-hole caps on which a very narrow thin gasket, which exposes only about $\frac{1}{64}$ in. of width to the pressure of the boiler, is used, was featured by the Casey-Hedges Company. The design used permits making the header with a minimum of material on account of the strengthening effect produced by the shaping of the handhole sides. The handhole plate and bolt are forged in one piece. The header shown was designed for 1,000 lb. working pressure.

The Foster Wheeler Corporation exhibited two sections of its new sectional air heater of the plate type, also a four-tube section of the improved Foster water-cooled furnace wall, in which wing castings are bolted

Photo by Kaufman & Fabry

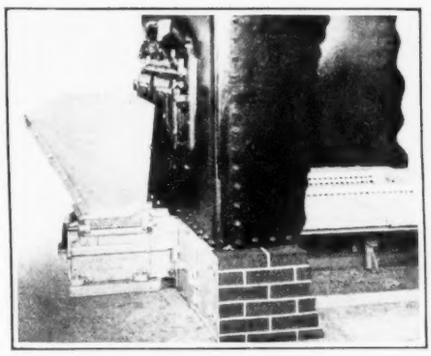
View of the exposition from the north balcony

on at the back of the tubes, leaving the front side of the tube bare, the blocks serving to increase the heat absorption on the back surface of the tube. An Aero coal pulverizer to which a few minor improvements have recently been made, was also exhibited by this company. The improvements include the adoption of ball bearings on the feed driveshaft in place of the bushing type, and the installation of a glass window and inspection light in the feed mechanism housing to permit the conditions existing in the feed chamber and around the magnetic separator to be observed at all times.



New Harrington stoker for heating boilers, shown with coal hopper removed

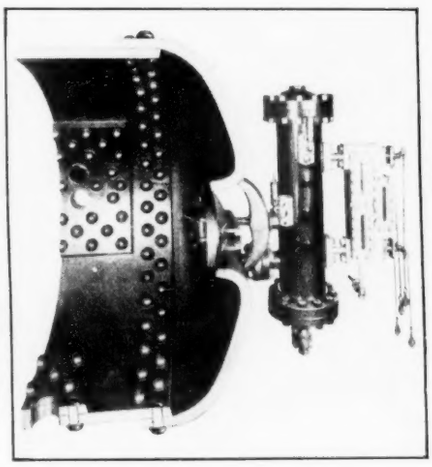
The latest types of refractory-faced water-cooled walls were shown by the Fuller Lehigh Company and the Bernitz Furnace Appliance Company. The latter company showed the recently developed "Thayer"-type wall in which carborundum blocks are applied to the fire side of the tubes and held in position by a tee-bolt, which fits in a slot in the block. This company also exhibited the type S-79 ventilated furnace floor for use with either pulverized-fuel or oil-burning furnaces.



Auburn automatic fireman for boilers from 50 to 1,400 sq.ft of heating surface

To the type of water-cooled wall already mentioned, in which the tubes are left bare but in which fins or wings are used to increase the heat, might be added those shown by the Combustion Engineering Corporation and the Drake Non-Clinkering Furnace Block Company. In the Drake armor-clad wall, metal block or escutcheons are cast on the front side of tubes and made a permanent part of them.

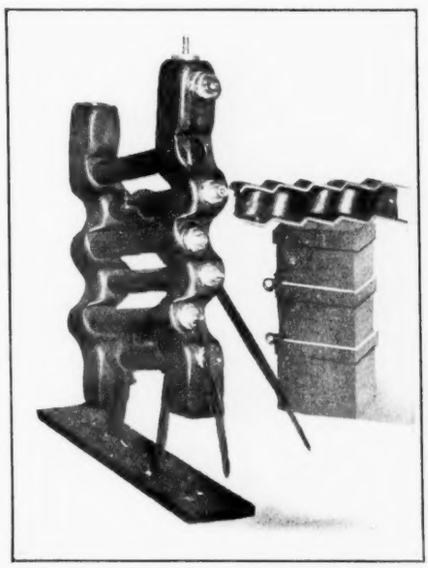
The Plibrico Jointless Fire Brick Company showed a section of a water-cooled wall in which Plibrico refractory was used to fill the space between the tubes and form the wall at the back.



Section of Walsh & Weidner boiler drum with head shrunk on the outside of the shell

Improved types of air cooled walls and arches were exhibited by the American Arch Company, Carborundum Company, Bigelow-Liptak Corporation and the Drake Non-Clinkering Furnace Block Company.

A working model of the "Unipulvo" coal pulverizer, to which a number of improvements have recently been made, was shown by the Strong-Scott Manufacturing Company. These improvements include the replacement of the skimmer plate, which was used to separate the coarse particles from the fines with a mechanical spinner, the use of a self-contained internal-gear speed reducer to drive the precrusher and feeder, and the use of tapered roller bearings on all machines having a capacity above 2,000 lb. of coal per hour. A circular burner of the vortex type is now used with this unit to secure greater turbulence of fuel and air and to give a slower entrance velocity into the furnace. Other pulverized fuel equipment exhibited included the latest type "Simplex" unit pulverizer shown by the Furnace Engineering Company, the improved Couch burner by the Combustion Engineering Corporation and the Pioneer burner equipped with an insulated front, shown by the Peabody Engineering Corporation.

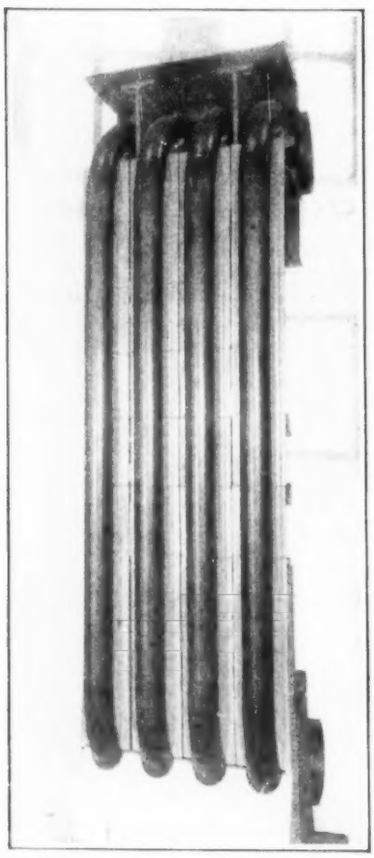


Casey-Hedges forged sinuous boiler header for 1,000 lb. pressure

The new Lehnco Regulator, designed for the individual or collective control of boilers in a battery, was shown at the booth of Himelblau, Agazin & Company. This regulator can be used for practically all purposes where a difference in pressure

is the controlling force and is particularly adaptable for cutting in or out, successively the individual unit in a boiler plant. This regulation is accomplished by a single regulator, it being unnecessary to have a separate regulator for each unit. The new split-shell-type heater of the Frank Heater & Engineering Company, and the new McNeil vertical liquid draft gage, in which the draft pressure is multiplied fifteen times, making the gage sensitive and easy to read when standing a considerable distance from it, were also shown by this company.

The exhibit of the Ernest E. Lee Co. was comprised of the product of a number of manufacturers whom it represents, and a number of new and improved pieces of equipment were displayed. These included a new Atwood & Morrill pilot-actuated back-pressure valve, and a continuous



Four tube section of improved Foster water wall

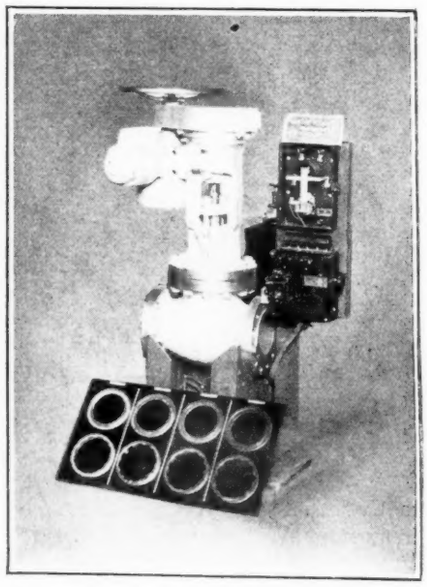
condensate drainage trap, which is now being fitted with stainless-steel valve, poppet and body rings. A new Copes combined feed water regulator and pressure regulating valve manufactured by the Northern Equipment Company used to control the quantity of water supplied to a boiler and in addition to control the water pressure differential. Two valves are employed, one being operated by the standard Copes thermostat and the other by a sylphon bellows. This exhibit also includes a new volute pump of the Manistee Iron Works Company, the new Uehling electrically operated CO_2 recorder and the Drake armor-clad water wall and air-cooled

Wellman supertest gate valve

furnace walls to which reference has already been made.

In the exhibit of the D. H. Skeen Company, which occupied probably the largest space at the show, and where the products of a dozen or more manufacturers were shown, a number of new things were to be seen. Included in these were a new type Henszey deconcentrator, or system of continuous blowdown in which there is a thermal recovery of the heat of the blowdown and the amount of the blowdown is held in direct proportion to the amount of impurities entering the boiler as determined by the amount of raw feed or makeup; a model of the Rolland-Gardner non-segregating coal distributor, which was described in the July 26, 1927 issue of *Power*. Full-sized samples of the latest development in piping manufactured by the M. W. Kellogg Company, including Dean high-pressure power-operated slide and swing gate valves, and a new Edward non-return valve, which was one of a number being furnished for the new Powerton Station of the Superpower Company of Illinois.

An improved model of a cinder-



Lunkenheimer motor operated gate valve with tight seating relay. Also exhibit of seating rings

eliminating fan, which it is claimed will remove 95 per cent of the total solids in the gases, was shown by the Buffalo Forge Company. The wheel used in the fan is the same as that used in the duplex and Turbo conoidal induced-draft fans, made for some years by this company. The removal of the cinders is accomplished by an inner scroll having a number of louver openings through which the cinders and solids are discharged to a collecting hopper in the bottom of the housing. Other pieces of new equipment shown by this company included a volume fan, or exhauster, for use in pulverized coal installations and other services, a non-clogging raw-sewage pump, which is being built in both vertical and horizontal types.

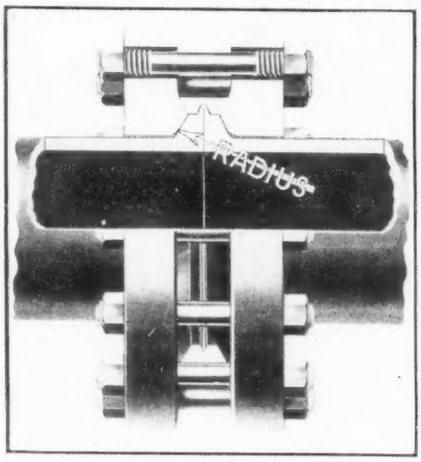
A new type of exhauster, in which the housing is designed to give good efficiencies with any one of six different wheels, was shown by the Clarage Fan Company. The types of wheels used with the fan include the type C, for high-pressure exhaust service, a rim-type wheel for slow speeds and wheels for blowing or conveying various kinds of materials. The housing is made in all standard sizes and adjustable for any of eight

different directions of air discharge. It is assembled with outside bolting to permit ready replacement of the scroll sheet and all anchor bolt holes are in line.

Included in the line of valves and fittings exhibited by the Reading Steel Casting Company was a 12-in. series 40 motor-operated cast-steel gate valve so designed that a motor operator can be readily attached, either in the factory or in the field, by simply removing the yoke cap and substituting a cast-steel bracket upon which the motor operator is mounted.

A new type of gate and globe valve, known as the Wellman Supertest, was shown by the Wellman Seaver-Morgan Company. These valves are made with forged steel bodies and bonnets and the seats, instead of being screwed or pressed into the body, are an integral part of a tapered removable valve cage which is fitted in the valve body and provided with an external take-up adjustment. An important feature of the valve is the fact that the valve cage can be utilized to shut off the flow through the valve while repairs or adjustments are being made.

A feature of the Henry Vogt Machine Company's exhibit, which included a line of drop-forged steel valves and fittings for high pressures and temperatures, was a section of a double-riveted joint in which each of

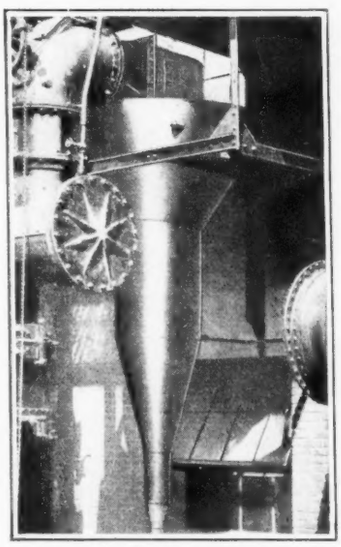


"Globack" pipe joint of the Midwest Piping & Supply Co.

the plates was 3 in. thick and the rivets 2½ in. diameter and 11 in. long. In making the joints, the holes are drilled to tolerance from solid plate and the rivets driven by a 275-ton riveter. This construction is used for high pressure oil refinery work.

A display of several different seating materials for high-pressure, high-temperature gate valves was a feature of the exhibit of the Lunkenheimer company. The purpose of the display was to show the unimpaired surface of the "Dielun" and "Hera" alloys developed by the company as compared with other materials, each set of seats having been subjected to the same cycle of tests under the same pressure and temperature.

A 6-in. 400-lb. motor-operated globe valve equipped with a tight seating relay which permits the valve disk to travel to its seat under power and to break the electrical circuit at a predetermined torque independent of



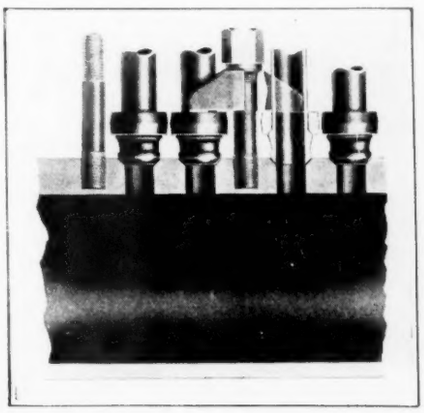
Sirocco type D flue dust collector demonstrated by the American Blower Co.

the setting of the limit switch was also shown.

Another new line of valves shown for the first time was the "Neway," introduced some time ago by the Kelly Company, of Chicago. In this new line of valves, which are of the gate type and were described in the Nov. 15, 1927, issue of *Power*, no permanent seat rings are used within the body. Instead, the seats are integral with inserts which screw in at each side of the body and form the pipe-line connection. These inserts can be any type desired, screw, flange, hub or spigot, and are readily interchangeable to suit any installation requirement.

Other recent developments in the line of valves was a 14-in. motor operated chrome nickel steel valve for 1,350 lb., shown by the Chapman Valve Company, and "Sigma" steel forged steel valves and fittings of the Walworth Company.

Innovations in piping found at the Show were a tee for 400 lb. built up to standard dimensions from tubing



Elesco superheater header forged from solid billet and drilled eccentrically

with each pipe connection Van Stoned, also a 90-deg. elbow made from pipe with forged steel flanges and the ends Van Stoned, shown by the Midwest Piping & Supply Company. The new "Globack" joint (illustrated), in which the back part of the lap is made spherical in shape to give additional strength, was also shown by this company.

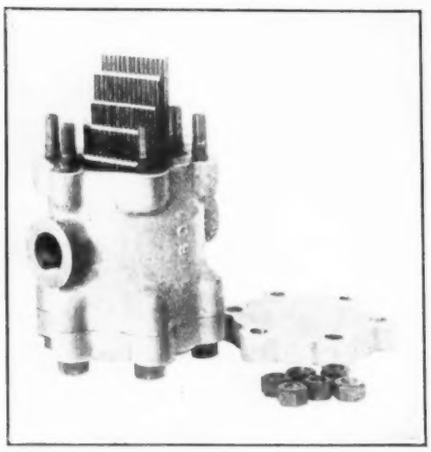
The Pittsburgh Piping & Equipment Company showed a corrugated expansion bend designed to take care of pipe-line expansion with a much smaller bend than is possible with the standard pipe. Rolled Van Stone type joints for high pressures and temperatures with extended lip for welding were also shown.

A working model of the Sirocco Type D flue dust collector was shown by the American Blower Company. This collector, although primarily designed for use in pulverized-fuel fired installations to separate the ash particles from the boiler gases, is applicable to other uses. The collector consists of a main casing of volute shape into which the dust-laden air or gas enters tangentially. Beneath the volute is a series of alternating truncated cones and cylinders which terminate in a dust outlet at the bottom. In passing through the collector the heavy particles are forced outward by centrifugal action and are carried downward, partly by gravity and partly by the conical formation, to the dust outlet.

One of the features of the Allis-Chalmers Manufacturing Company's exhibit was the showing of 250 hp. 1,800 r.p.m. line-start motors, which are to be installed in the New State Line Power Station. The motors have cast-steel frames, the upper part of the frame being slightly raised and inclosed to give a perfect water shield and also permit adequate ventilation. The windings are waterproofed and the coil ends are substantially braced. A type "SSU" centrifugal pumping unit, in which the pump casing is integral with the motor housing and the impeller overhung on the motor shaft, was also shown. This pump was described in the Dec. 27, 1927, issue of *Power*.

Fairbanks-Morse & Co., in addition to a small Diesel generating set and its standard line of pumps and ball-bearing motors, showed a cut-away model of the Price turbine deepwell pump, the sale and manufacturing rights to which it has recently acquired. This pump is designed for use in single or any number of stages, depending upon the working head and amount of water desired.

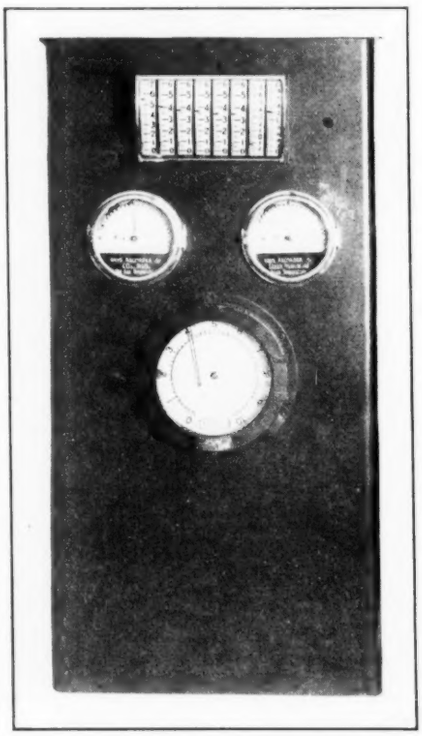
The latest type of turbo-vane induced-draft fan with automatic vane control on the inlet was the principal feature of the B. F. Sturtevant Company's exhibit. These vanes serve to control the pressure and volume of air delivered over the complete operating



Pipe line Tracyfier exhibited by Andrews Bradshaw Co.

range without changing the speed. A type 14 turbine complete, with automatic nozzle control and speed reduction gear designed especially for driving power plant auxiliaries, tubular and plate type air heaters and industrial vacuum cleaners, were included.

A section of a new eccentric Elesco superheater header (illustrated) designed for a pressure of 800 lb. and a final temperature of 735 deg., was included in the exhibit of the Superheater Company. The header is forged from a solid billet and then bored eccentrically. The tubes are connected at the thick part of the header by the standard Elesco metal-to-metal ball joint. A similar type of header is being used in a superheater unit now under construction for 1,400 lb. pressure. This company also showed enlarged sectional ele-



Hays new boiler panel with flush type instruments

vations of boilers with Elesco superheaters.

Four new types of air filters, known as the Simplex, Dri-drum, Air-mat sectional and Dri-dust separator, were shown by the National Air Filter Company. These new filters, together with the standard Phoenix and rotary filters which have been manufactured for some years by this company, constitute a line adaptable to practically any service or filter requirement.

A $1\frac{1}{2}$-in. pipe line Tracyfier for use in lines carrying steam, air, gas or water, was a new product shown by the Andrews-Bradshaw Company. This new unit employs the same type baffles as used in the boiler Tracyfier. It is made with screwed connection and with flanged covers and is suitable for pressures up to 250 pounds

New equipment shown for the first time by the Hays Corporation in-

Diamond motor-operated soot blower

cluded a boiler panel equipped with multi-pointer draft gage, flush type CO_2 and temperature recorders and a steam-flow meter (illustrated). Also an improved Orsat complete with direct reading pyrometer and draft gage mounted in a convenient carrying case and the improved model of the Hays electrically operated CO_2 recorder.

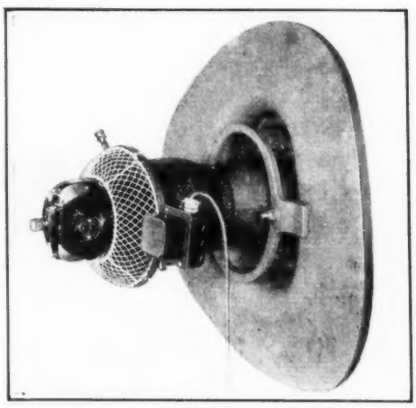
The Bristol Company showed a liquidometer particularly adapted for indicating the level of liquids of varying specific gravity, also improved models of B-F valves for controlling the flow of air and oil to burners, or air and gas to any service, and the B-K valve for controlling the flow of steam.

A new line of dial-type pointer draft gages, built along the same lines as the multi-pointer vertical line gage introduced about a year ago, was shown by Lewis M. Ellison. The gage is of exceptionally substantial construction and is fitted with a bell of 8 cu.in. displacement. The scale is white celluloid 10 in. long and of excellent visibility, with black graduation and large figures.

An improved line of orifice meters, equipped with a new mechanical integrator, was featured by the Foxboro Company in addition to its standard line of instruments.

A steam gage for high pressure, in which the Bourdon tubes are made from a special bronze, lathe turned and fitted with screwed ends, was

included in the exhibit of the Crosby Steam Gage & Valve Company. In this new gage the entire working parts are mounted on a bracket which is fastened to the case at the bottom only. The new Crosby fluid pressure



Coppus boiler manhole blower

scale for testing gages to pressure up to 3,000 lb. was also shown.

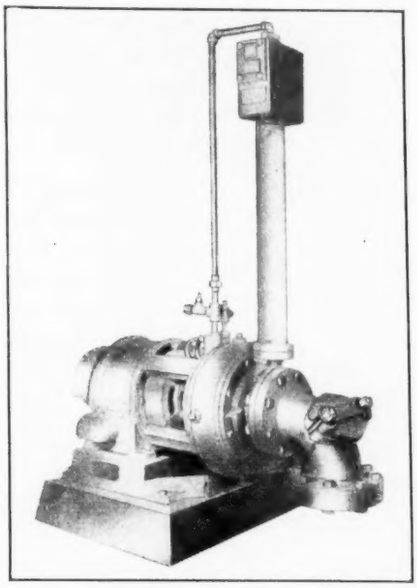
Several models of the Reeves variable-speed transmission, with the improved double-block center-pull V-belt were featured by the Reeves Pulley Company. Another improvement recently made to these units is the mounting of the radial-ball bearings inside recesses of the frame sides to reduce the overall width of the unit.

A motor-driven manhole blower for cooling the inside of boilers when inspecting, cleaning or repairing, was exhibited by the Coppus Engineering Corporation. This unit is similar to the Coppus heat killer, which is fitted with a tripod stand and swivel joint and is adaptable to a variety of uses in the power plant as well as industrial fields.

A new cement gun in which the mixture of the air and cement is done at the nozzle, so that the mixture can be regulated by the operator to give the coating desired, was shown by the S. Obermayer Company. A pressure regulating valve is provided on the machine to give the air pressure required, and a means is provided for stirring up the mixture with air pressure when necessary.

The new Yarnall high-pressure water column equipped with high and low water alarm and "Secure" water gage, which was described in the October 18, 1927, issue of *Power*, was featured by the Yarnall-Waring Company, together with its line of tandem blowoff valves, spray nozzles and other accessories.

In the exhibit of the United Conveyor Corporation two types of conveyors were shown actually conveying material. One was the improved United steam-jet conveyor operated by remote control, whereby steam is used only while ash is actually being hoed into the system. The other was the "Nuveyor," a pneumatic conveyor of comparatively recent development; the conveyor can be operated by a positive blower or steam-jet exhauster as desired. The conveyor operates by suction all the way to the discharge point. A sectional cast-iron ash tank was also exhibited. The entire tank is made of cast-iron plates supported inside of a structural steel frame. Where the material stored is damp, steam jacketed plates are used at the bottom to prevent freezing.



Jennings suction sump pump shown by Nash Engineering Co.

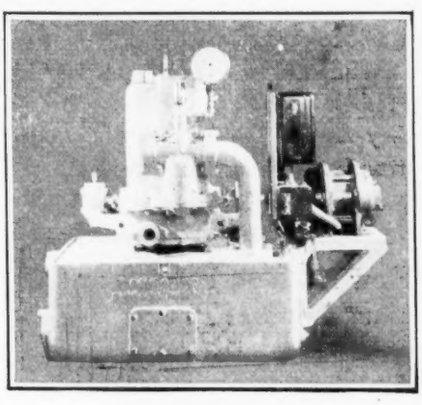
The Reliance Electric Company showed models of its fully inclosed motors (illustrated), which are now being made in sizes from 1½- to 15-hp. with the usual speed and voltage ranges.

A new condensation vacuum pump, known as the "Condo-Vac," and an improved type of "flush-kleen" submerged sewage ejector were shown by the Chicago Pump Company. In the new vacuum pump an air impeller for exhausting the air from the system and an impeller for discharging the water to the boiler are mounted together in one horizontally split casing.

Another new unit shown by this company was a cellar drainer consisting of a vertical motor-driven pump equipped with float control, the whole being supported by a tripod frame with the motor placed about three feet above the pump.

A self-priming centrifugal pump of the single-stage inclosed impeller volute type was a feature of the exhibit of the Nash Engineering Company. In this pump, which is designed to obviate the need for steam or air ejectors for priming, a small built-in vacuum pump is mounted on an extension of the same shaft that carries the pump impeller and motor armature. When the pump is started, this small air impeller exhausts the air from the pump casing and suction piping, thus priming the pump. This company also showed the Jennings suction self-priming sump pump, which embodies the same principle and is designed for mounting above the sump or some distance from it if necessary.

Other new equipment in the heating and ventilating field included a new unit heater for 350 lb. pressure by the Aerofin Corporation, a unit air conditioner by the Carrier Engineering Corporation, the Young type return-line pump in which water jets are used to produce the vacuum, by the C. A. Dunham Company, the new "Thermolier" unit heater and Equiflo valve by the Grinnell company, a new electro-chemical valve by the Johnson Service Company, various types of



"Condo-Vac" vacuum condensation pump of the Chicago Pump Co.

unit heaters by the Modine Manufacturing Company, Herman Nelson Corporation, Reed Air Filter Company, Mechanical Manufacturing Company and the Rome Brass Radiator Company. More complete description of this equipment will appear in an early issue.

EDITORIALS

Power Shows

OPINION as to the power show situation seems to fall into three groups—those who contend that the present frequency of shows incurs a financial burden far in excess of the returns, those who continue to find them a profitable investment, and those who maintain that the shows, as commercial enterprises, are there for manufacturers who find it profitable to exhibit, hence interference by groups of exhibitors is unwarranted.

It is but natural that, among over five hundred exhibitors, whose products fall within twelve or more groups, unanimity would be improbable. As a starting point, however, there can be little disagreement with the show idea. It is fundamentally sound and has been handed down through generations. Under present conditions shows furnish an opportunity for the manufacturer to present, for visual inspection, his advertised wares, and as such they form a part of his selling program. The point to determine is the economic frequency beyond which it may not pay the manufacturer to exhibit and beyond which the effect may be detrimental to the whole show idea. This point will vary to some extent with the different groups of equipment.

In the final analysis the solution must rest upon what is best for industry, and from this point of view it must be recognized that the manufacturers of equipment and the show managements have the most to gain through frank co-operation.

While the New York and the Chicago shows, because of their prominence, occupy the center of the picture, they are but two of many shows which the equipment manufacturer has to consider. Hence his problem is largely one of self-determination.

How Do You Use Your Copy of *Power?*

JUST how to get the most value out of the publications to which one subscribes is a problem that faces everyone. This is particularly true when the publication is an engineering magazine, such as *Power*. Much of the value in this type of magazine is not apparent from a hurried inspection. Each issue must be studied carefully if the reader is to realize to the fullest extent its manifold possibilities.

But unfortunately, few have the time to carry out such a study. The manifold distractions of modern life, added to the exacting calls of the job, have seriously curtailed the time available for reading of any kind. This curtailment has even affected "bread-and-butter" papers like *Power*.

For these reasons much interest attaches to a scheme worked out by the superintendent of a certain industrial power plant. He receives his copy of *Power* at his home. There he reads it, giving it all the time he can spare. He marks everything in it that he thinks will be helpful to the plant. Then he takes it to the plant and passes it around among his power and maintenance foremen.

The foremen read the marked articles and note everything else that interests them. Finally, on Sunday, when the work is generally light, the superintendent and his men all get together and talk over what they found in the issue in hand. Many improvements in equipment and operation methods are said to have come out of this practice.

Here is a method that solves the problem of the limitations on a single man's time. By having some half-dozen men go over each issue in this way, that part of its contents useful to their plant is almost sure to be brought out by someone, without any of them having spent more than an hour or two. Other plants may well profit by following this example.

Light for the Benighted

ON ANOTHER page of this issue there is announced a project of the McGraw-Hill Book Company to publish a series of works under the general title of "Frontiers of Science Series."

Someone has remarked that an expert is the man who knows more and more about less and less. Unfortunately, the specialized expert needs to know things outside his immediate field, and he is usually a man of a high degree of intellectual curiosity, so that he wants to know a great many things for which he has no immediate daily need. Frequently, he finds no source of information that gives him what he wants without forcing him to spend valuable time reading elementary explanations of things that he has understood for years. This new venture in the field of scientific literature is designed to meet the needs of this man, whose general scientific knowledge is rather complete, but who wishes to know what has been done in various special fields since he graduated from college.

The project is worth watching. It should prove useful in many quarters.

Installment Buying of Machinery

IF INSTALLMENT buying of luxuries and articles of short life can be justified, it would seem that the partial-payment method could logically be applied to power plant machinery.

A few machinery manufacturers have ventured to adopt installment selling, but they have found it necessary to carry the financial burden. So far none of those companies handling the major part of automobile paper have found the machinery field worth cultivating. This is probably due to the fact that an engine or boiler is less mobile than an automobile or even a bedroom suite. Since the machine is of greater worth, the resistance of the purchaser to recovery without extensive legal procedure by the seller or seller's agent is greater.

The practice of a finance corporation is to require the machinery builder to indorse the buyer's notes or at least to agree to take up any unpaid balance in event of the purchaser's failure to meet his obligation. This system is of little assistance to a machinery builder, since each sale is a liability until completely paid for.

An additional handicap lies in the character of laws in the several states. A partial-payment sale contract perfectly legal and necessary in Texas would be void in Missouri. As a consequence the builder who essays to do his own financing is confronted with almost unsurmountable difficulties.

Undoubtedly, the only way through which partial-payment buying of machinery will become as common as that of automobiles is through some form of an equipment trust. In most of the states, equipment trust contracts are legal, and the purchaser of such notes would be safeguarded in that the notes could cover the sales to so many different power plants as to make the risk negligible.

Cost of Power Not the Only Consideration

SUPERPOWER, Giant Power and other high-sounding terms, which caught the imagination of both engineer and layman a few years ago, are now much in the discard. They have been replaced by the more prosaic, less romantic term "Interconnection." But even at this, the degree to which interconnection of power systems has extended is probably beyond the expectation of the earlier champions of the practice. This has all come about through orderly development following economic laws, with nothing revolutionary or spectacular. But the facts are, that Boston has been tied to Chicago and the latter to Pensacola, Florida, with power lines, permitting step-by-step interchanges of energy.

There are many benefits derived from interconnection of power systems, but they are not going to revolutionize the transmission of power electrically or its cost, as one might have been led to believe when this practice was first talked about.

Interconnection provides for a wider distribution of power than would be possible with independent systems. It will make for greater reliability of service. The more ways a load can be supplied the greater the reliability. Larger system operations are made possible by interconnection, and this in turn allows the installation of larger and more efficient units. These units can be operated to better advantage on the large system, as it will in general have a better load factor. This better use of equipment reduces the investment in plant equipment.

Large interconnected systems make possible a more efficient use of developed water power and also may allow the development of water power that could not be economically utilized otherwise. On many streams the flow varies through wide ranges, and when plants on such streams are tied into large systems, these plants can be operated to the best advantage.

Local conditions will influence the advantages to be gained from interconnected power systems. These advantages do not necessarily mean a reduction in the cost of power. The interconnection of two or more systems could be justified on the basis of greater reliability or the more efficient use of a water power, even at a slightly increased cost. Reliability of a power supply is looked upon today as possessing equal and, in some cases, greater importance than cost.

Imagine the Savings!

IMAGINE what a difference it would make in the costs of some industrial plants if the air lines for process and maintenance work were as well installed and cared for as the piping in the power plant. A little compressed air leak may seem a small thing to a production man. But in many cases it may add just enough to the cost of an operation to convert a profit into a loss.

The logical thing to do with air piping is to place it under the supervision of the power engineer. He knows piping and how it should be maintained. Unfortunately, some production men are jealous of what they call their rights and try to keep the power engineer in the power plant. And still others do not seem to realize how much the power engineer could lessen their troubles by giving them compressed air when and as they need it—cheaply.

And the management is often prone to consider such a service as compressed air too unimportant to merit serious consideration, when so much time is required by the more important problems of production. But, if they did realize the close relation of good air service to economic production and insisted that the power engineer took over this service and administered it properly, imagine the savings that could be made.

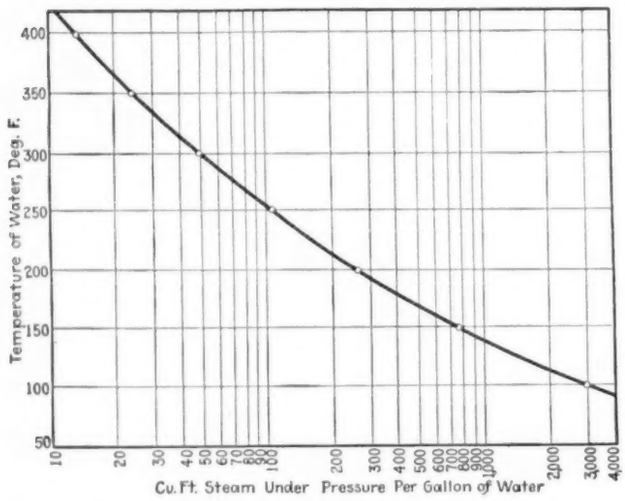
IDEAS *from* PRACTICAL MEN

Readers are urged to use this department for the exchange of practical operating information. A minimum of five dollars will be paid for contributions accepted

Volume of Steam From One Gallon of Water

THE question was asked me by one of our water-plant men, "How much steam do you get from a gallon of water?"

He was not satisfied with my answer of "about eight pounds," so I made up a curve for my own information as well as future inquisitors.



Curve shows amount of steam from a gallon of water at various temperatures

This curve gives the number of cubic feet of steam under corresponding pressures, obtained from one gallon of water under given temperatures.

Cleveland, Ohio. C. W. STEVENS.

Regulating the Air to an Oil Burning Furnace by the Appearance of the Smoke

IN OIL burning plants which are not completely equipped with instruments, the regulation of the air to the fires is usually governed by the appearance of the smoke issuing from the stack. The manufacturers of oil burning equipment usually recommend that the air be so regulated that a light brown haze of smoke will issue from the stack.

In a great many plants it is necessary for the fireman to go some distance to get within sight of the top of the stack, and therefore he does not watch the smoke as closely as he should.

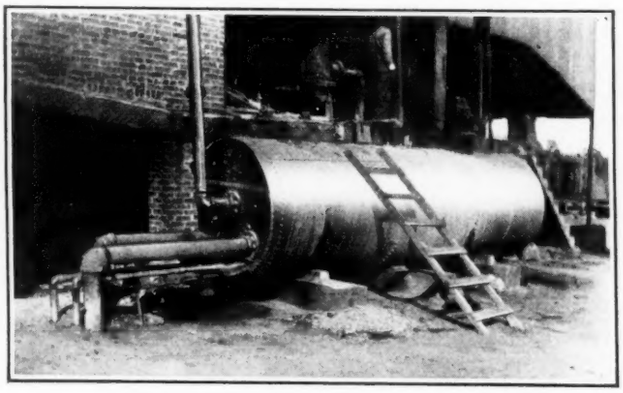
In plants equipped with water-tube boilers of the type that has the small dusting doors in each side of each pass, a 50-watt electric bulb of the clear glass type may be hung in front of a door near the top of the last pass. If the door on the opposite side is opened, the light may be seen across the pass of the boiler. If the air supply is as it should be, the filament of the bulb should be seen clearly but not brightly across the pass of the boiler. The proper appearance of the light across the pass must be determined by comparison with the smoke issuing from the stack. Once this appearance is determined for a particular plant and the firemen know just how bright the light should appear, it is easy for them to observe the smoke condition frequently.

This idea may be used where the construction of the boilers does not permit the use of the method described above, by making two small holes opposite each other, at some convenient point in the breeching and fitting these holes with plugs or covers. The observation may then be taken across the breeching.

Brooklyn, N. Y. P. F. CALLAGHAN, JR.

How an Old Boiler Was Made Into a Feed-Water Heater

THE illustration shows an old steam boiler of the horizontal return-tubular type that was converted into a heater at small cost. The tubes were removed and the heads reinforced with an extra steel plate, which was riveted over the tube-hole section of the original heads,



Old boiler made into a closed heater

as shown. The boiler was then mounted on timber saddles and connected through a 2-in. pipe line with an elevated water tank and a small pump. The discharge side of the pump connected with a coil inside of the old boiler made from 300 ft. of 2-in. pipe. The exhaust steam from the various engines and other steam-operated

equipment in the plant is connected to one end of the old boiler as shown in the illustration, and the steam passes over the coils and gives up heat to the water, the excess steam passing to the atmosphere through a back-pressure valve set to release at 3 lb. The pump draws the water from the reservoir and forces it through the coil in the heater to the plant boilers. L. M. JORDAN.

Cairo, Ga.

Making Use of the Indicator

THE steam-engine indicator sometimes is useful in other ways than indicating a steam engine, at least we have found it so. We attached it to the steam drum of a battery of boilers once in an effort to find out why the pulsation of the steam pipe was so great. We did not get as much information as we had hoped, for the variation in pressure was too slight. However, we did demonstrate that the risers from the boilers were ample in size; at least we could not detect any difference in pressure between the boiler and the end of the riser.

The company installed some wet sandblast machinery which did not give satisfactory service, so we attached the indicator just behind the blast guns and, by pulling the drum cord by hand, got diagrams that indicated that the steam piping was too small.

Lately, the master mechanic designed a machine on which there was a 3-in. air cylinder, the air being admitted and exhausted by a hand-operated slide valve. The cylinder was designed for ample power, but it would not do the work when put into service. Upon connecting the indicator, we found that the initial pressure was 65 lb. and the back pressure was 40 lb. A few changes in the valve gave all the power needed.

In pressure problems the engineer should not forget the pressure gage and the indicator. Many times we get all fussed up looking for trouble in a pump or other pressure apparatus when a gage would tell us at once where the difficulty was. J. O. BENEFIEL.

Anderson. Ind.

Repairing Concrete

REPAIRS may be made easily to an unsightly hole in a concrete floor or to a corner knocked from an engine foundation, but something more is required than merely to apply a dab of concrete or cement mortar and finish it smoothly to match its surroundings.

Such a repair will last but a short time, when the applied concrete will become loose and fall from place. New concrete will not bond with the old. In order to secure a good tie between old concrete and new, three requirements must be fully met.

There must be no loose or adhering bits of concrete. There must be no grease upon the surface to be repaired. There must be no weathering of the old concrete; the particles must be clean and free from carbonization or other atmospheric effects.

In order to meet all these conditions fully, first brush the surface thoroughly. Use a stiff fiber or wire brush and, with an awl or some sharp-pointed instrument, carefully search out and remove any little pieces of old concrete that may have spalled off. Then give attention to cleanliness of the surface. Never touch the surface with the fingers after it has been made clean by using lye in water. Make the mixture so strong that it makes the fingers sore; this is about 104 deg. by a hydrometer, or, as the old-time soap-makers used to say, the solution will float an egg.

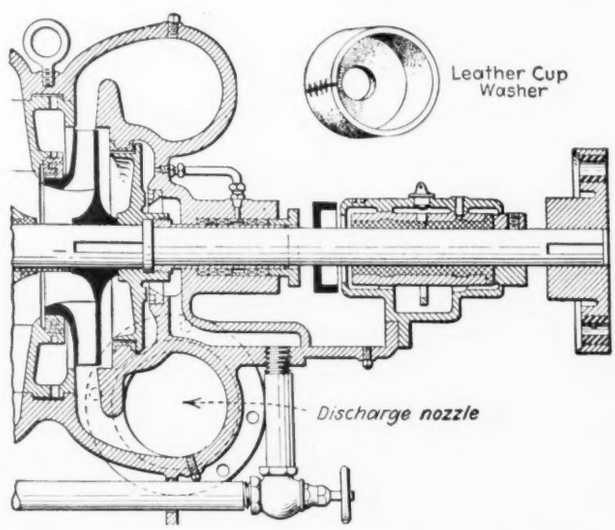
With a clean fiber scrub brush apply the solution to the surface to be repaired, scrubbing it patiently and thoroughly until every trace of oil and grease has been removed. Next wash off the lye with many flushings of clean water. In a wooden or earthen vessel mix muriatic acid with water until a bit of old concrete placed in the solution will show a faint boiling effect, which means that the acid is attacking the concrete. Do not make the acid solution strong enough to boil vigorously when it comes in contact with the concrete. With the acid solution and a fiber brush scrub the concrete surface thoroughly until the weathered concrete has been dissolved by the acid and an entirely new surface has been exposed.

Next, wash off all the acid; not a particle must be left on the concrete, or the new concrete will separate from the old. Do not let the surface become dry before applying the new concrete. Better plan the concrete mixing so that the mixture will be ready as the final washing has been completed. JAMES F. HOBART.

Indianapolis, Ind.

Keeping Water Out of the Bearings on Centrifugal Pump

IN A centrifugal pump the water packing gland is usually within a few inches of the thrust bearing on one end and the main bearing on the other. Considerable



Leather cup washer prevents water creeping along the shaft to the bearing

trouble is frequently had from water creeping along the shaft and into the bearing, causing the oil to float out.

We overcame this trouble by cutting an old leather hydraulic elevator valve cup to fit the shaft snugly. The cup was cut down one side to the center and slipped over the shaft with the flange toward the water seal. The joint was then laced with wire and the cup pushed close to the packing gland. Any water leaking from the gland is now thrown off before reaching the bearing.

Buffalo, N. Y. A. D. MEAD.

COMMENTS *from* READERS

Bending Pipe

REGARDING recent comments in *Power* on bending pipe and tubing, I would like to hear from some readers on elongation of pipe under process of bending; also their methods of obtaining end-to-end dimensions, or face-to-face dimensions where pipe must be cut and threaded before applying heat and bending. Do atmospheric conditions or temperatures figure in these calculations?

W. A. ROBERTSON.

Long Beach, Calif.

* * * *

Surface Condenser Heat Transfer

IN HIS articles on condenser design appearing in the April 19 and Nov. 15, 1927, issues, Professor Dana not only leaves himself open to criticism as a student of heat transmission and condenser practice and design, but has treated the subject with a definite finality not warranted by our present knowledge of heat transmission. The subject of condenser practice is probably the most controversial one in engineering literature. Practically every statement he makes could be challenged, but not posing as an authority on the subject, I will limit my remarks to a few of the more obvious items.

First, referring to Fig. 1 (issue of April 19) why was the conductivity of copper given when brass tubes are referred to in both Fig. 2 and Fig. 3? The conductivity of copper is about four times that of brass. Why was 50 to 650 deg. F. selected as the temperature range when 32 to 125 deg. F. would have covered all condenser practice? Where were the data obtained from? Fig. 1 shows Dana's data compared with a reference from the Smithsonian physical tables with brass added as a matter of interest. Of course, Dana's data may be on commercial copper, which might cause the difference in value and slope as well. The exact value for conductivity of the metal is, however, of but passing interest in condenser work because of its insignificance when compared with other factors.

Values quoted from Bell and Bancel appear reasonable enough in themselves, but why are values of 922, 1,210 and 1,433 for K at $2\frac{1}{2}$, 3 and 6 ft. per sec. velocity obtained from calculations, using their data when similar values from Dana's calculation curve Fig. 5 are but about 530, 595 and 805 for the same velocities?

The data he quotes on page 586 and uses for Figs. 2, 3 and 5 are taken from McAdams and Frost's paper in the Jan., 1922, issue of the *Journal of Industrial and Engineering Chemistry*. The paper is based on a number of tests, seven of which were with steam. Parts of the data are reproduced in Table I.

In this table h_v, h_w and velocity were taken directly from tabulated data, while U was calculated from the data on steam and water temperatures and total heat transmission.

U = total heat transference coefficient in B.t.u. per sq.ft. per hr. per deg. F.

h_v = heat transmission coefficient in B.t.u. per sq.ft. per hr. per deg. F. from steam to brass pipe.

h_w = heat transmission coefficient in B.t.u. per sq.ft. per hr. per deg. F. from brass pipe to circulating water.

These tests were made on a 0.675 in. outside and 0.49 in. inside diameter brass tube 47.75 in. long, placed concentric in a $1\frac{1}{2}$-in. steam jacket. The authors stated that they were trying to determine coefficients for predicting values of h_v which they thought varied with a coefficient of proportionality, cleanliness factor, thermal conductivity of tube, fluidity of condensate, velocity and hydraulic radius of the pipe.

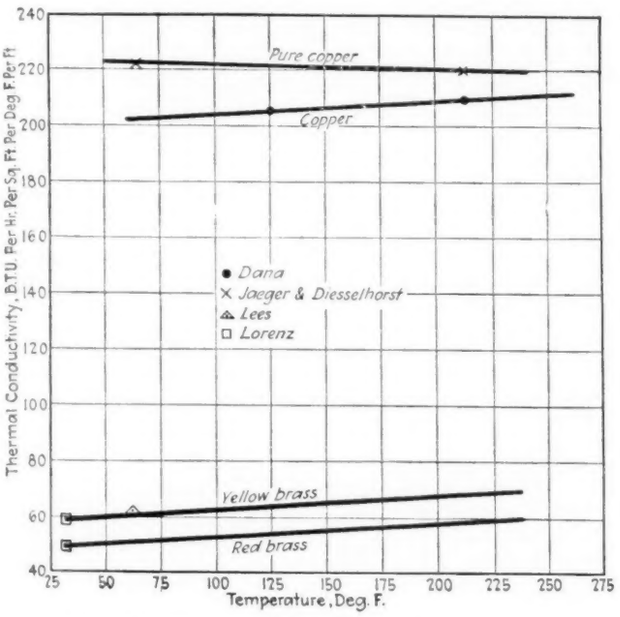


Fig. 1—Heat conductivity coefficients from Smithsonian tables

TABLE I—DATA FROM TESTS BY McADAMS AND FROST

Run	U Outside Surface	h_v Outside Surface	h_w Inside Surface	h_w Outside Surface	Velocity, Ft. per Sec.
1	598	2,190	1,280	930	5.39
2	596	2,110	1,300	945	6.90
3	632	2,060	1,420	1,032	7.16
4	642	2,150	1,460	1,062	7.45
5	488	3,360	851	619	3.06
6	438	2,310	805	585	3.31
7	443	2,475	789	574	3.20

In discussing the values of h_v, the authors say: "The observed coefficient of heat transfer from condensing

steam to pipe is about 2,400 B.t.u. per hour per deg. F. per sq.ft. which checks fairly well with Clement and Garlands' range of 1,470 to 2,410. Of course, there is no reason to believe that the percentage of air in the steam was the same in the two series." This indicates the impracticability of using these data as Professor Dana does.

It is evident that Professor Dana plotted his Figs. 2 and 3 directly from the published data, entirely overlooking the fact that h_v (Dana's Fig. 2) was based on the outside surface of the tube, 0.703 sq.ft., and h_w (Dana's Fig. 3) was based on the inside surface of the tube, 0.510 sq.ft.

Now, condenser data are always based on the outside surface of the tube, so that h_w as published would have to be reduced in the ratio of 0.510 to 0.703.

By laboriously combining these curves Figs. 2 and 3, Dana arrives at his Fig. 5, which could much easier and accurately have been drawn from the original data direct. These various curves are shown in Fig. 2, and the difference between the correct values of K and h_w and those used by Dana are evident.

In other words, Dana takes data which McAdams and Frost carefully segregate into their component parts and tries to put these parts together without finding out how they were analyzed.

That the values shown by combining Dana's Fig. 2 and Fig. 3 cannot be combined accurately as he has done, is shown by the following analysis of Run No. 1. The mean temperature difference between steam and water was 70.9 deg. C., and the total heat transferred 53,600 B.t.u. per hour. The over-all coefficient U, is 598. Based on a temperature difference of 19.30 deg. C. from the steam to the pipe h_v is 2,190, while h_w, based on the temperature and surface of the inside of the pipe, is 1,280. The temperature difference was 45.6 deg. C. Dana has apparently overlooked not only the fact that the data he used were based on the inside surface of the pipe, but that a temperature drop of 6 deg. C. was allowed through the tube.

The error of this oversight is apparent. Calculating U from h_v and h_w, both based on the outside diameter would give

$$\frac{1}{U} = \frac{1}{h_v} + \frac{1}{h_w} = \frac{1}{2{,}190} + \frac{1}{930} = \frac{1}{658}$$

or about 60 B.t.u. higher than it actually is. Using the data as Dana did without correcting for inside surface, would make matters worse.

$$\frac{1}{U} = \frac{1}{2{,}190} + \frac{1}{1{,}280} = \frac{1}{815}$$

or an error of 217 B.t.u. per sq.ft. per hr. per deg. F. Furthermore, he uses the data with no reference to tube size or length or to water viscosity. The latter factor for these tests is probably about half what it is in ordinary condenser practice.

Neglecting the thermal conductivity of the tube in this case causes an error of about 10 per cent, considerably higher than Professor Dana estimates in the last paragraph on page 585.

In the end he makes no use of anything but the final Fig. 5. Why go to all the bother of combining two curves? Furthermore, even if he were correct, why design a condenser on the basis of five tests with 210 deg. F. steam and one 0.675-in. tube 4 ft. long when there are thousands of other more practical tests available?

Why does he either overlook or neglect the paper "Heat Transmission from Condensing Steam to Water in Surface Condensers and Feedwater Heaters," by McAdams, Sherwood and Turner? This paper is in the 1926 volume of the A.S.M.E. Transactions. It summarizes practically all the authentic experimental data on condenser tubes and also gives an analysis of the heat transfer coefficient which divides it into four parts: vapor side, scale, tube and water side resistance. Furthermore, it is a flexible workable equation where no

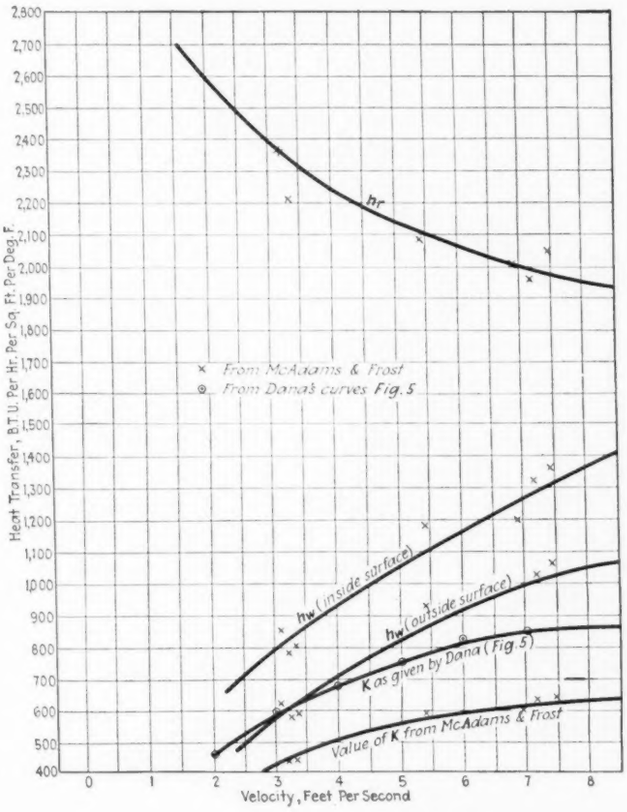

Heat Transfer, B.T.U. Per Hr. Per Sq. Ft. Per Deg. F.
Velocity, Feet Per Second
hr
× From McAdams & Frost
⊙ From Dana's curves Fig. 5
hw (inside surface)
hw (outside surface)
K as given by Dana (Fig. 5)
Value of K from McAdams & Frost

Fig. 2—Heat transfer coefficients

item is neglected. Tube resistance can be calculated from the equation

$$r_t = \frac{a}{K}\left[\frac{2D_o}{D_o + D}\right]$$

where r_t = tube resistance; a = tube thickness; D_o = outside tube diameter; D = inside tube diameter; K = thermal conductivity.

The water-side resistance can also be predicted, using an adaptation of the McAdams and Frost equation mentioned previously. The steam side and scale resistances have not been investigated as yet, but have been lumped together. Their combined value is about $\frac{1}{2{,}000}$ for new tubes or about $\frac{1}{1{,}500}$ for commercial well-kept condensers.

J. J. Alden

Los Angeles, Calif.

Tractive Effort and Factor of Adhesion of a Locomotive

I CANNOT wholly agree with the answer given to question No. 7 in the Nov. 1, 1927, issue as to why a locomotive engineer, in starting a long string of cars, does not put the throttle in wide open position so that the cylinders will have full boiler pressure.

I am a stationary engineer, but have been on several locomotive dynamometer tests, and have taken indicator diagrams on these locomotives. The tractive effort of a locomotive is the power applied to the rail, and a locomotive usually has a factor of adhesion of at least 4. This factor of adhesion is the ratio between the tractive effort and the weight on the engine's driving wheels. For example: An engine weighs 240,000 lb. on the drivers and has a maximum tractive effort of 50,000 lb., then 240,000 ÷ 50,000 = 4.8, or the factor of adhesion. In starting a long string of cars, the engineer cannot open his throttle wide immediately, because the slack in the train would be yanked out and broken couplings would result. After this slack is out, no matter how slowly the engine is moving, the throttle may be opened to the full position.

If an engineer could not open the throttle full on starting a string of cars, because the drivers might slip, he would have to ease off on the throttle when on a long grade where high tractive effort would be required. I recall being on a freight-engine test, and on several different occasions we were not given a helper engine up over our worst grade, still we proceeded, slowing down every second, until we finally stalled with the throttle open wide and the engine exerting its maximum tractive power, and yet it never slipped a turn of its drivers.

Watertown, N. Y. J. V. ELSWORTH.

* * * *

Can a Throttling Governor Be Applied to a Corliss Engine?

WITH reference to the inquiry of O. M. Hamilton, in the Jan. 3 issue, "Can a Throttling Governor Be Applied to a Corliss Engine?" I do not believe that it would be practical to do so. Of course, it can be done, but it would be like jumping out of the frying pan into the fire. I do not believe that a throttling governor would regulate the speed over a wide range of load nearly as close as the regular Corliss governor.

There is no reason why Mr. Hamilton's engine should not regulate over a range of no load to about half load unless there is something wrong with the valve setting or the governor.

I was called into a plant not long ago where the bracket on the governor post that holds the reach-rod shaft in position had been broken and welded. In welding the bracket, it was next to impossible to get the two pieces exactly in their original position and this caused the pins on the rocker shaft to bind in the reach-rod bearings to the extent that the governor would not regulate the speed of the engine. With no load the engine tried to run away, and with a load it slowed down. I took off the reach rods and filed out the rocker-pin bearings where they were binding. After replacing the reach rods the engine ran as smoothly as it ever did. This engine has a load that varies constantly and over a wide range.

I would suggest that Mr. Hamilton examine his governor to see that it does not bind. He can do this by shaking the reach rods or by disconnecting the rocker shaft on the governor from the governor shaft and seeing that it works freely; or it may be that the oil in the dashpot, if his engine has one, is too heavy. If his engine is located in a place where the cold air can strike it and there is heavy cylinder oil in the pot, this may cause his governor to be sluggish in responding to the variation in load. However, if the governor is not regulating properly and there is nothing binding so that the governor is free and the valves are set properly, there is only one remedy so far as I know, and that is to put a heavier flywheel on the engine provided the shaft is strong enough to carry one. In my opinion there is nothing that will regulate the speed of a Corliss engine carrying a wide range of load as will a heavy flywheel. It is taken for granted that the proper size of steam pipe has been installed. It is best to use a size about two inches larger than the throttle valve. J. W. STEPHENS.

Staunton, Va.

Answers to "What Do You Know?"

The questions are on page 369

Ans. 1—The Boiler Code of the American Society of Mechanical Engineers specifies that the hydrostatic head shall be 300 per cent of the working pressure.

Ans. 2—The first large American gas engines were of the Koerting two-stroke-cycle type and were installed at the Buffalo plant of the Lackawanna Steel Co.

Ans. 3—In melting, or sublimating, the carbon dioxide forms a layer of insulating gas about the package so that the heat absorption is much reduced.

Ans. 4—The cost of a horizontal return-tubular boiler is about 55 per cent that of a water-tube boiler.

Ans. 5—The balls will all revolve in the same plane.

Ans. 6—Hot water disintegrates the rubber so that the valve soon is destroyed.

Ans. 7—The low heat value of a coal is found by deducting from the total heat value, the latent heat of the water vapor formed by the combustion of the hydrogen content.

Ans. 8—If the coal is in larger sizes the individual lumps do not completely burn by the time they reach the dump, unless the stoker is run slowly, which would reduce the output of the boiler.

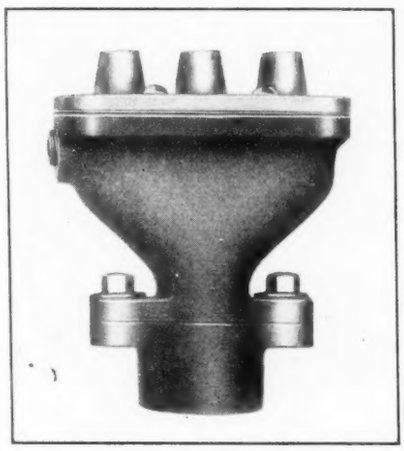
Ans. 9—In the conventional type the worm threads are all the same diameter. The threads of the Hindley worm are made of a larger diameter at the ends of the worm than at the center, so as to make the worm fit the arc of the gear. One of the chief objections to this type of worm was the necessity to keep the bearings accurately adjusted to maintain the worm centered on the gear, to prevent binding and cutting of the worm and gear.

Ans. 10—The losses will be increased four times. Doubling the current will double the voltage drop in the line. For example, with a load of 100 amperes, if the line drop is 10 volts, increasing the load to 200 amperes will cause 20 volts drop. The watts loss in the line is equal to the current in amperes times the voltage drop. In the first case the line loss would be $100 \times 10 = 1{,}000$ watts and in the second $200 \times 20 = 4{,}000$ watts.

New and Improved EQUIPMENT

Cable Terminal for Low-Voltage Circuits

A NEW line of low-voltage terminals for indoors has been recently placed on the market by the Standard Underground Cable Company, Pittsburgh, Pa. They are designed for mounting on the end of pipe conduit or connected to the sheath of a lead-covered cable by means of stuffing-box gland or plumbers' wiped joint. These terminals are made of cast iron with bakelite insulating tops and conductor outlets, the joints being made by gaskets.



Three-wire type of terminals

They are suitable for terminating low-voltage power or control cables or similar low-potential conductors. The terminal shown in the figure is designed for three conductors, but they are to be had for almost any desired number of wires.

Bernitz Carborundum Water-Wall Blocks, "Thayer Type"

THE purpose and advantages of water-cooled walls of the bare refractory covered types as applied to boiler furnaces is now well known. The adaptation of these walls to water-tube boilers above 5,000 sq.ft., particularly where they are to be operated much above normal rating, is becoming frequent practice.

The illustrations herewith show the "Thayer Type" carborundum water-wall block recently introduced into the field by the Bernitz Furnace Appliance Company, 80 Federal St., Boston, Mass.

Referring to the illustration, which shows the details of the block as well as front, rear and sectional views of the wall assembly, the block is shaped to fit against the face of the tubes. The central portion of the block, which extends between the tubes, is fitted with a tee slot to take the head of the holding bolt. This portion does not fit tightly

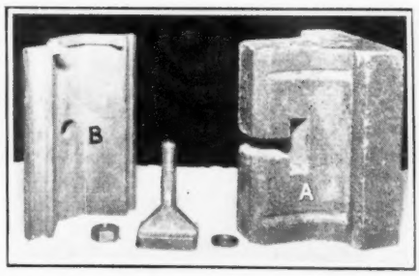


Fig. 1—Detail of block with backing plate and bolt

to the tube nor does it touch the backing plate when in position.

When the wall is assembled, the circular face *A* of the block and surface *B* of the backing plate are buttered with special carborundum cement so that, when the block and plate are in position, there is a good heat-conducting surface completely surrounding the tube. The horizontal joints between the blocks are also laid with this cement, but the vertical joints are left open to care for expansion.

A feature of the wall is the method used to space and align the tubes properly and at the same time support the carborundum blocks. This allows the individual blocks to be held in place with only slight tension on the backing bolt. Only enough tension is applied to partly collapse the spring washer, thus permitting expansion of the blocks without undue tension. By referring to the section, Fig. 2, it will be readily apparent how this is accomplished. A spacer bar support casting *C* is rigidly clamped to the tubes at every sixth block. This casting carries the weight of the blocks above, and for this reason it is not necessary to clamp the blocks tightly to the tubes.

When used with stoker-fired furnaces, the two lower blocks, which are next to the fuel bed, are increased in thickness as shown in the front view of the wall (Fig. 2), so as to provide longer life before replacements become necessary.

It is claimed by the manufacturer that the blocks have a co-efficient expansion per degree F. of 0.0000026, a decomposition temperature of 4,060 deg. F. and a thermal conductivity of 100 B.t.u. per square foot per inch thickness per degree F. per hour at temperatures of 1,600 to 2,400 deg. F. The blocks are made for any size tube spacing.

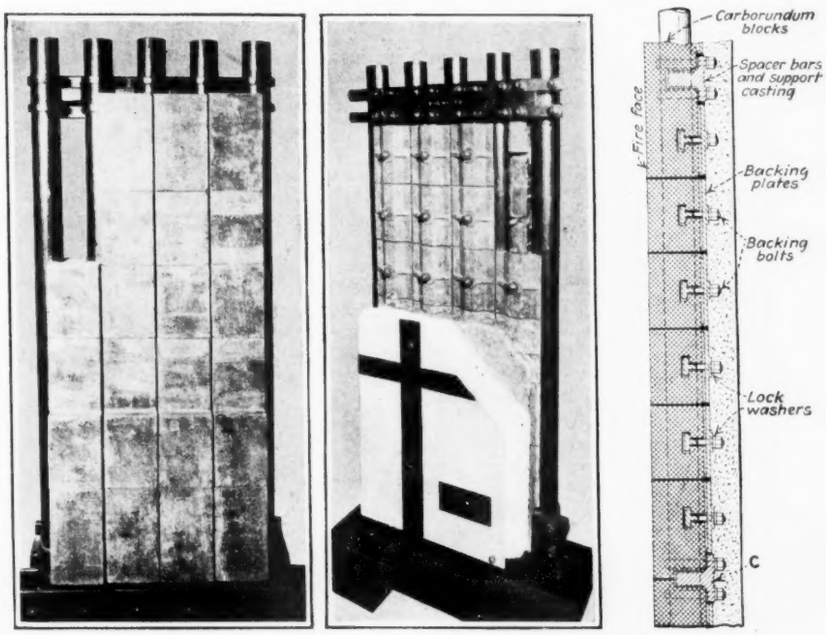


Fig. 2—Front, rear and cross-sectional views of water wall assembly

Ideal Pressure Grease Lubricating System

TO ELIMINATE the danger hazard in connection with the lubricating of the bearings on various types of power and industrial plant equipment, as well as reduce the labor and amount of time required to do this work, the Ideal Lubricator Company, 2120 Packard Building, Philadelphia, has brought out the pressure-operated greasing unit illustrated. Fig. 1 shows a typical installation on an underfeed stoker, and Fig. 2 shows the controlling valve and pressure unit or distributor.

The distributor is placed at some convenient point adjacent to the machine to be lubricated, and a main distributing pipe is carried across the machine with a small rigid or flexible connection to each bearing.

The distributor is a brass cylinder with closed ends, having connections at

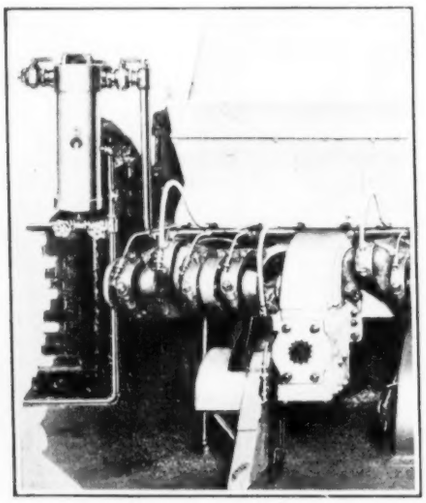
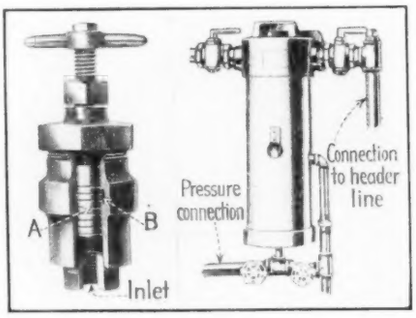


Fig. 1—Installation of ideal system on underfeed stoker

the bottom for the purpose of introducing pressure under a piston, two of which are fitted to a common piston rod. A column gage is also fitted to the cylinder to indicate the amount of grease in it at all times.

The upper end of the cylinder is the grease reservoir, which is filled by removing the top with the piston in the down position. When the top is replaced, steam, air or water pressure is admitted at the bottom, and this causes the piston to rise and force the lubricant out through the connections at the top to the various bearings. The amount of grease supplied to each bearing is controlled by the regulating valve shown in Fig. 2. The grease is forced into the bottom of the valve and through a thread *A* chased in the movable core of the valve to the outlet channel *B* in the body of the valve. The amount of grease to each bearing is regulated by screwing the core in or out, which decreases or increases the amount of thread through which the grease is forced. This valve provides a ready means of compensating for the drop in pressure due to the length of pipe line through which the grease



Figs. 2 and 3—Regulating valve and pressure unit

is forced. Once the correct position of the threaded core is determined, it is locked in position by the jam nut on the stem directly above the bonnet.

Improved Oxweld Cutting Blowpipe

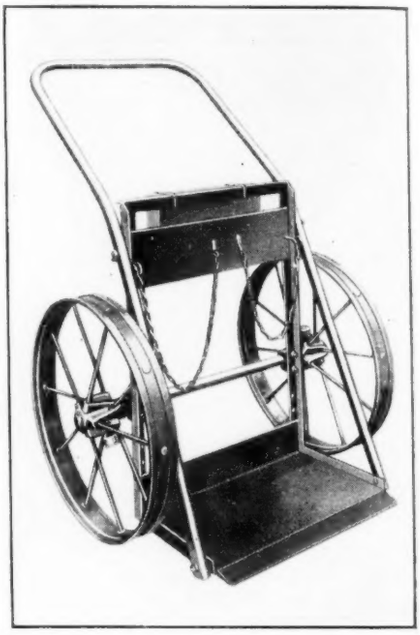
A NEW cutting blowpipe, known as type C-14, which it is claimed will not backfire even under the most severe operating conditions, has been added to the line of cutting and welding blowpipes put out by the Oxweld Acetylene Company, 30 East 42nd Street, New York City.

This blowpipe uses the same nozzles as the Oxweld type C-2, although several improvements in design have been made. The three gas tubes are straight, having no bends either outside or inside the handle. The cutting valve is of the same design as has been used on the type C-6 for several years. The small needle-valve bodies are pressure forgings instead of castings, giving better appearance, increased durability and lessened weight.

Interchangeable nozzles are provided so that the blowpipe may be used with either medium- or low-pressure acetylene. Although the medium-pressure nozzle cannot be used with low-pressure acetylene, the low-pressure nozzle can be used with a medium-pressure acetylene supply if low pressure is maintained in the hose and blowpipe. To accomplish this, the regulator should be adjusted to give a flame showing an excess acetylene cone not more than one inch long when the acetylene valve on the blowpipe is wide open. The acetylene valve should then be adjusted to obtain the neutral flame.

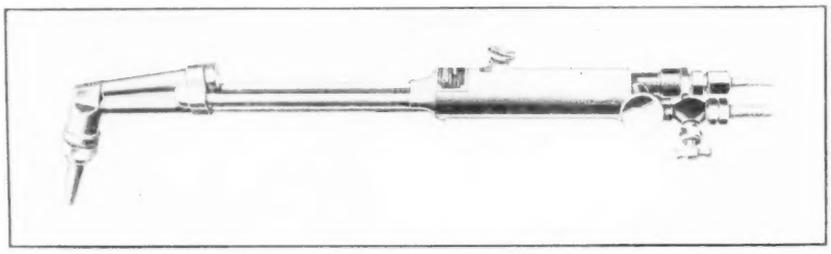
Truck for Oxyacetylene Equipment

THE illustration shows a new truck for oxyacetylene welding and cutting equipment, equipped with 24-in. steel wheels, recently introduced by the Oxweld Acetylene Company, 30 East 42nd Street, New York City. The handle on the new truck is continuous, and the upper portion is bent back about eight



Truck with 24-in. wheels

inches, so that the truck can be easily handled by an operator of small stature. The tool box is larger and is provided with a cover and a holder for extra blowpipe tips. Where 24-in. wheels are not required, 14-in. wheels may be used instead, merely by changing the position of the axle to the lower set of holes, which are already drilled in the frame.

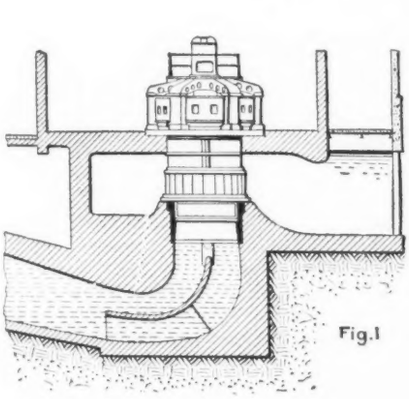


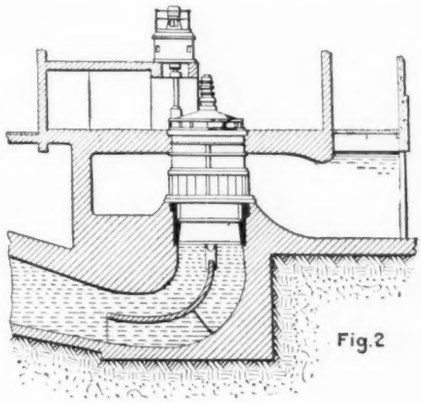
Oxweld type C-14 cutting blowpipe

Geared Hydro-Electric Unit Used in Low-Head Plant

IN MODERN hydro-electric practice in this country, high-speed generators geared to waterwheels have been used in very few installations. On the other hand, in Europe this combination has been used to a considerable extent. An interesting case of this kind is described in the *Demag News*, Duisburg, Germany. One unit of this type is installed in the Munderkingen station. The flow of the river is about 890 sec.-ft. and the effective head 7 ft. 8 in.

Comparative calculations made in designing the plant, showed that vertical units with adjustable blading on propeller-type wheels, and coupled with geared generators, would be the most economical machines for utilizing the power available. In view of the relatively low head even a turbine of a type designed for maximum possible speeds (propeller turbines) would have attained a speed of only about 83 r.p.m. If direct-coupled turbines and generators had been used, this would have meant slow, and consequently large, electrical equipment, Fig. 1.





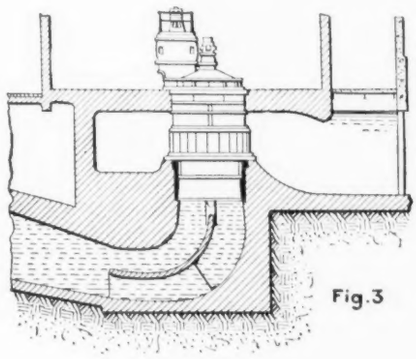
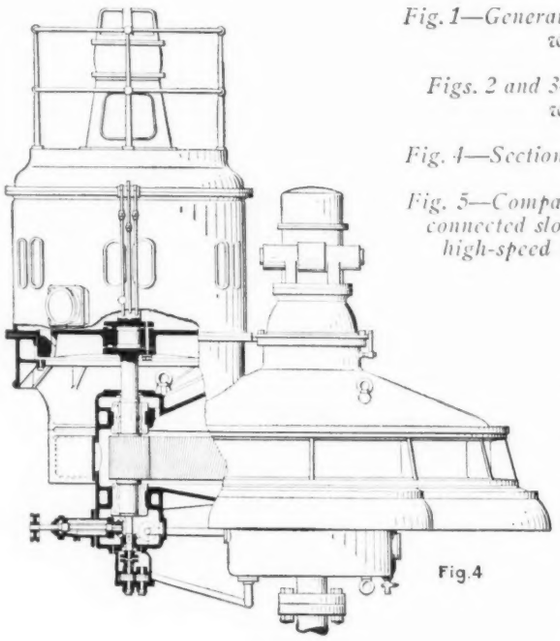


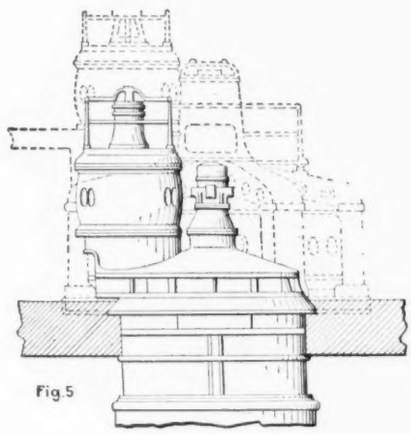
Fig. 1—Generator directly connected to waterwheel

Figs. 2 and 3—Generator geared to waterwheel

Fig. 4—Section through generator gear

Fig. 5—Comparison of size of directly connected slow-speed generator and high-speed generator with gear





Generators of this type are much more expensive in initial cost than high-speed machines coupled with their driving turbine by gears. Even then, their efficiency still remains less than that of a high-speed generator including the gear. Besides, the weights of the various component parts are much higher with a low-speed machine than with a high-speed one, a fact that influences the size of the crane and other accessories in the power house.

As it is possible to manufacture gears of high efficiency that are reliable and have smooth running properties, direct-connected low-speed generators are being superseded more and more in Europe by high-speed generators connected with high-grade gears to waterwheels, because these units are more economical and satisfactory generally from the electrical point of view.

When using gears, there are two possibilities of combining them with the generator. Fig. 2 shows the first method, where the generator is set on a platform, an intermediate coupling being placed between the generator and the pinion of the gear. The Munderkingen plant is, however, built according to the second method, shown in Figs. 3 to 5. The platform for the generator is in this case omitted, and the over-all height is consequently reduced considerably. This method of construction requires close co-operation on the part of the firms building the gear and the generator. Fig. 5 shows the favorable proportions obtained in the construction of the geared generator, the full-line drawing showing the arrangement adopted and the dotted lines the other constructions that could have been used.

The generator has an output of 1,000 kva. at 50 cycles, 5,250 volts and 850 r.p.m. The stator of the generator consists of a cast-iron housing. It is mounted directly on the lid of the gear housing, which is designed accordingly, Fig. 3. The bearing bracket containing the thrust bearing of the generator is supported on the stator housing. Above this the exciter is placed in the usual way. The stationary bearing surfaces of the thrust bearing are divided into a number of equally loaded segments. The load it has to take consists of the weight of the rotor plus that of the pinion shaft coupled to it, the total weight being approximately 5.5 tons. As the gear has ordinary slanting teeth, it was possible to choose the angle of slant so as to relieve the thrust bearing by the aid of the axial pressure of the pinion when the latter is running.

Owing to the rigid coupling of the rotor and pinion shaft no lower guiding bearing is used on the generator. There are only three guide bearings—the two pinion bearings and the upper guide bearing of the generator. This arrangement resulted in a particularly small over-all height. Like the gear, the rotor is designed for a maximum speed of 1,800 r.p.m. In order to obtain sufficient WR^2 effect, a flywheel is provided between the flanges of the rotor and pinion shaft. This flywheel also acts as a fan to force air through the inclosed generator.

The turbine governor is driven from the pinion shaft through a bevel gear in the ratio of 1:1. The geared oil pump flanged to the gear housing is driven by the pinion shaft through the medium of a flexible coupling at its lower end. The shaft of the large gear and the turbine shaft are connected by a rigid flange coupling. This coupling is hollow, so as to permit of taking the adjusting rod of the impeller blades through it.

The axial load of the waterwheel shaft consists of the weight of the impeller wheel, the gear wheel and the hydraulic load, and amounts to about 40 tons. This load is taken by a bearing with tapered rollers contained in a cylindrical superstructure on the lid of the gear. The gear cover is conical in shape and designed according to the stresses acting upon it. It also has to carry the generator, weighing about 12 tons. The cover is made of cast steel and in repeated tests with a load of 52 tons showed a deflection of only 0.0028 to 0.0031 in., which disappeared entirely as soon as the load was removed.

A CORRECTION—In the article on automatic expansion valves, by H. G. Venemann, in the Jan. 24 issue, the Fig. 1 was called a load-demand valve. This was an error, as the illustration showed a Baker automatic expansion vavle.

RECENT PUBLICATIONS

Frontiers of Science Series

IN THE Middle Ages it was the ideal of the scholar to master the entire field of human knowledge and men seriously considered this within the bounds of possibility. It was customary each year for the faculty of a university to meet and draw lots to determine who should teach mathematics, who philosophy, who Greek, and so on. As one of our modern professors has said, the medieval professor did not occupy a chair, he occupied a whole settee.

Today such catholicity of knowledge is quite impossible for even the most gifted scholar. For the man who must engage in practical every-day affairs even narrower restrictions are felt, and yet his mind reaches out eagerly and peers forth into the dark unknown surrounding his little corner of the universe of knowledge.

There is no relief for such a man in the numerous outline stories in which scientific knowledge is chocolate coated for the consumption of those who have little intelligent grasp of the underlying fundamentals of science. These books are written largely for the relatively unschooled reader. The specialist (presumably somewhat schooled) who undertakes to read one, finds that he has to wade through a mass of ABC's to find a little real information fit to engage an adult mind. There is plenty of highly concentrated technical literature and plenty of predigested popularization, but very little information on the progress of science for the fairly well educated reader who wants to know something about developments outside his own specialty.

To fill this gap, the McGraw-Hill Book Company, Inc., is undertaking to launch a new series of scientific books, to be known as the "Frontiers of Science Series."

Each volume will be independent and the series will ultimately cover the entire circle of the sciences. Inasmuch as modern research must bring to bear on the problem in hand information from all quarters, the traditional and artificial divisions into separate studies in the conventional college curriculum will not be followed. Each volume will treat a certain investigation in its entirety, although it may involve several of the various divisions of science.

The publishers will be assisted in the selection of authors and topics by the trustees and editorial staff of Science Service of Washington, D. C., headed by Dr. Edwin E. Slosson, director of that organization.

The announcement of this project should be good news to every intelligent man of scientific training.

MINERAL RESOURCES OF THE UNITED STATES, 1924. Two Volumes: Part I, Metals; Part II, Non-metals. Published by the United States Government Printing Office, Washington, 1927. 589 and 728 pages. Price, $1 each.

THESE volumes collect between covers the various individual reports on metals and non-metals that have been issued by the Bureau of Mines recently, containing data up to 1925. Of principal interest to power engineers are the sections on petroleum, pages 385 to 458, Vol. II; and on coal, coke and coke byproducts, pages 459 to 728, Vol. II. Of this latter section 240 pages are devoted to a study of the production and marketing of coke and its byproducts, which is of value to all fuel users interested in coke as a fuel.

STRATIGRAPHY AND GEOLOGICAL STRUCTURE OF NORTHERN ILLINOIS WITH SPECIAL REFERENCE TO UNDERGROUND WATER SUPPLIES, by F. T. Thwaites, is the title of a report issued by the Illinois State Geological Survey, to inform engineers and water-well drillers regarding the depth, thickness and character of the water-bearing rock. The author of this report has studied the various formations in their outcroppings in Wisconsin, and for the purpose of this report has used his experience and knowledge in interpreting the well cuttings from northern Illinois, where these formations are more or less deeply buried. The territory that is covered in Illinois reaches as far south as Kankakee, Streator, Galva and Aledo. Copies of this report may be obtained at 50c. each, by addressing Dr. M. M. Leighton, Chief of the State Geological Survey, at Urbana, Illinois.

WATER POWER RESOURCES OF CANADA. The Dominion Water-Power and Reclamation Service of the Department of the Interior of Canada has recently issued the annual review of the water-power resources of Canada, developed and undeveloped, as of Jan. 15, 1928, according to the most recent information available. This bulletin describes the actual progress of water-power development, the use of water power in central stations and in the pulp and paper industries, capital invested in water-power development, the coal equivalent of developed water-power, with estimates of the developed and undeveloped water power in each province. Copies of this bulletin may be obtained free of charge on application to the Director of the Dominion Water Power and Reclamation Service, Ottawa, Canada.

NEWS *of the* FIELD

Boulder Dam in Committee—But Progress Slow

Consideration of Boulder Dam legislation is proceeding in executive session before the Irrigation and Reclamation Committee of the Senate. The bill is now being read for amendments, but progress, however, is reported to be slow. There has been no change in the position of the House Committee. The majority and minority reports are scheduled to be filed March 15.

One of the points brought out in connection with consideration of the legislation is that the plans and estimates of the reclamation service for the Boulder Dam were made at a time when conditions were different. Even then there was not complete agreement among the engineers on some of the fundamental facts. It is charged by some of the opponents of the plan that the engineers who made important reservations at the time the studies were made have gradually been eliminated from the Bureau of Reclamation, or have voluntarily transferred their activities to private work. It is contended that if the men formerly employed in the Reclamation Service, who devoted much time and energy to the problem, were called upon to express themselves, that many of the engineering conclusions now being drawn would be thrown into question.

Engineers to Dedicate Louvain Memorial July 4

The new Louvain Library, restored by American benefactions, after being destroyed by the Germans during the World War, will be dedicated on July 4 of this year, according to present plans.

The Belgian Ambassador and Whitney Warren, of New York, the architect, have both assented to this date, Engineering Foundation announces, and the sanction of the Louvain authorities is expected.

The Foundation's committee is arranging for the presence of a delegation of American engineers at the dedicatory ceremonies. Under the auspices of the Foundation, a clock and carillon will be placed in the tower of the new library building at a cost of $80,000, to be subscribed by members of the engineering profession in this country.

Up to Jan. 25, $32,000 had been contributed by 1,880 engineers in amounts of 25 cents to $5,000, Dr. Edward Dean Adams, chairman of the Foundation's committee in charge of the movement, reports. The mechanical engineers lead in the amount of subscriptions, with the civil engineers second, the mining engineers third, and the electrical engineers fourth. Associated societies have given $927, and $5,250 has been received from friends.

Summer Schools to Continue for Engineering Teachers

The Summer School for Engineering Teachers which was established by the Society for the Promotion of Engineering Education in 1927 is to continue its sessions during the coming summer. Two schools will be held: one for teachers of physics and the other for teachers of electrical engineering. As in 1927, when mechanics was the subject studied, the purpose will be to study the principles and methods of teaching rather than to review actual content of subject.

The session on the teaching of physics will be held at the Massachusetts Institute of Technology under the direction of Dr. S. W. Stratton, president of the Institute. The session on electrical engineering will be held at Pittsburgh under the joint auspices of the University of Pittsburgh and the Westinghouse Electric & Manufacturing Company. Dr. F. L. Bishop of the University of Pittsburgh, secretary of the Society for the Promotion of Engineering Education and Professor Charles F. Scott of Yale University, chairman of the Society's board of investigation and co-ordination will serve as co-directors of the Pittsburgh session of the School. Professor H. P. Hammond, Associate Director of the Society's Investigation of Engineering Education is in general charge of the Schools. Both sessions will be of three weeks, starting July 6.

President Favors Revision of Flood Control Bill

President Coolidge is opposed to the bill drafted by Representative Frank R. Reid (Rep.), of Illinois, chairman of the House Flood Control Committee, and reported favorably from the Committee with reference to flood control of the Mississippi River Valley. He is doubtful if the bill will work out in a practical and satisfactory way, since it seems to have no definite plan, and he is having the Army engineers prepare a report on the measure in an effort to have the bill revamped in a satisfactory manner. This was stated officially on February 21.

British Plant Gets Power from Sewage Gas

IN 1921 J. D. Watson constructed a plant at the Colehall, England, sewage disposal works, where the fuel for a 34-hp. gas engine was the sludge gas coming from the sewage. In 1925 the board engineer, H. C. Whitehead, had an exhaustive investigation made to determine what amount of power might be expected from the much larger quantities of sludge available at Saltley.

It was taken that the quantity from which gas might be collected economically was about 100,000 cu.yd., and it was estimated that the power available from the gas previously liberated to the atmosphere was about 1,100 hp. continuously day and night. This led to the installation of a three-cylinder vertical National gas engine of 150 b.hp., during a 100-kw. 4,000-volt alternator and 144 floating gas collectors.

The success of the project depended on the design and construction of a cheap and efficient type of gas collector, as there were serious difficulties in the way of the plan of covering the tanks completely with some form of roof. The principle of the floating type of collector of moderate dimensions was considered the best to adopt, and experiments were carried out to observe under practical conditions the behavior of the more suitable materials of construction. As a result it was decided to install floating reinforced-concrete gas collectors for use with the first unit of the plan, on account of low initial and maintenance costs and of efficiency in gas collection. The form adopted consisted of a raft 20 ft. in length and 10 ft. in width, bounded by vertical sides extending two feet above and two feet below the raft, and forming two open compartments, the lower of which was for the collection of gas, while the upper provided the necessary displacement for floating the mass.

The gas is drawn off from a pyramid formed on the center of the raft. The size of the collectors was limited by the maximum permissible weight, which was about nine tons in this case.

The plant was officially put into service at the end of September, 1927, and has for some time been working on full load. The engine, as supplied by the makers, was of standard pattern and design, but certain adjustments had to be made to suit the high calorific value of the gas.

Early Vote Seen on Power Lease at Wilson Dam

The Senate, Feb. 20, made the Norris Muscle Shoals resolution the unfinished business before that body. This probably indicates an early vote on the proposition to lease the power developed at the Wilson Dam and to use the proceeds for the experimental production of fertilizer. The Norris resolution is objected to by some members of the Senate on the ground that it opens the way for the entry of the government into the electric power and fertilizer businesses.

Senator Sackett, of Kentucky, has offered a substitute resolution which provides more specifically for the promotion of the use of concentrated fertilizers on the nation's farms. His resolution also carries the item to which objection is made, authorizing the Secretary of War to construct transmission lines.

Trade Commission Clears for Action on Power Inquiry

Immediately upon the passage of the Walsh resolution by the Senate, the Federal Trade Commission began its preparations for the handling of the work. It is very evident that the commission has been put on its mettle by the charges made in the Senate and a very thoroughgoing job appears to be in prospect.

In view of the doubts expressed on the floor of the Senate as to the power of the commission to comply with all features of the resolution, the commission has invoked its own powers to initiate investigations in order to remove any question as to its authority to investigate at the behest of a single branch of Congress. It was pointed out that the commission has the right to initiate an investigation covering every phase of the inquiry ordered by the Senate.

Constitutional Amendment for Flood Control

An ammendment to the Federal Constitution making possible effective measures of flood control is urged in the report of the American Engineering Council's Committee appointed recently to consider the problems arising from the Mississippi River floods.

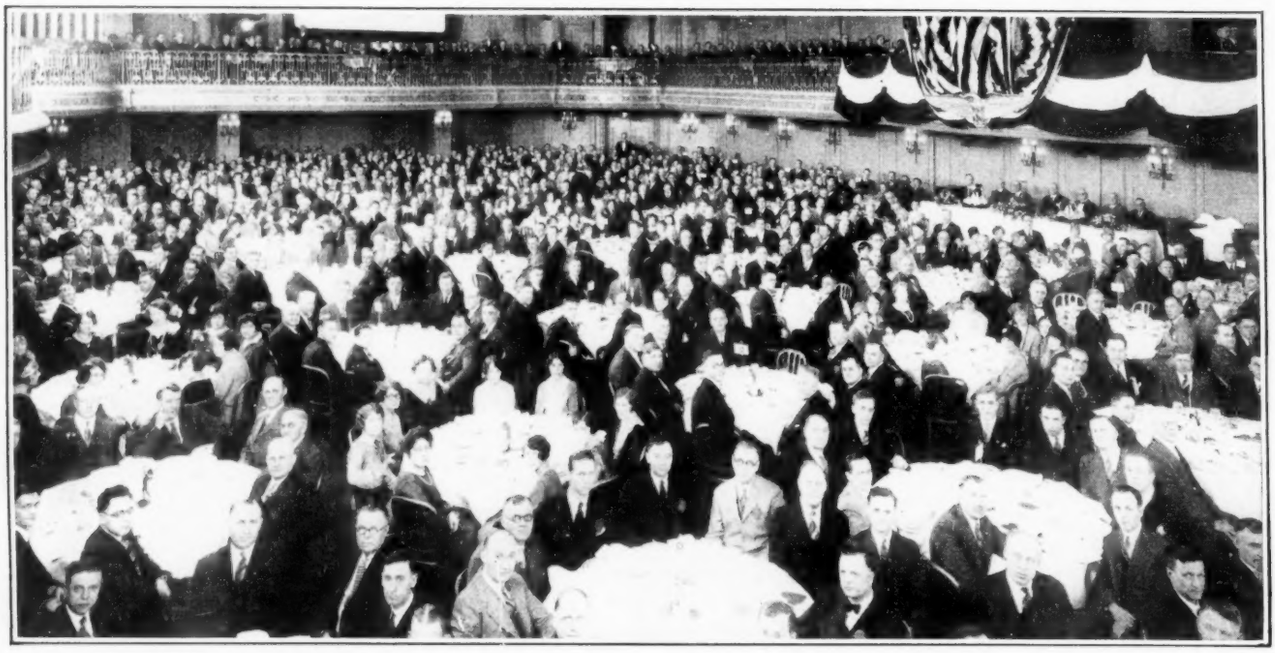
"It is the opinion of this Committee," the report declares, "that the authority of the general government to deal with such questions as are involved in the Mississippi River problem should no longer hang upon such slender threads as the general welfare clause, or the regulation of commoerce clause of the Constitution, but that the Constitution should be amended to confer upon the general government the authority to control and administer the national waters and to assess damages and allocate benefits and costs in connection therewith.

"It is our further opinion that only by the procedure which such an amendment, followed by the passage of a Federal Water Control law, would make possible can an equitable or justifiable distribution or allocation of the costs of river improvement and flood protection be assured. The Committee, headed by Gardner S. Williams of Ann Arbor, Mich., vice-president of the Council, recommends the appointment of a Mississippi River Conservancy Board.

Huge Pumps for German Power Station

It has been decided by the Rheinisch-Westfalisches Elektrizitatswerk to construct a storage reservoir for its Hengstey water-power station in Westphalia, the plans of which have already been prepared. Hydraulic turbines of the Voith spiral-casing type, each developing 45,000 hp., are to be installed. The plant is also to be equipped with three Sulzer high-lift centrifugal pumps, each driven by a 34,000-hp. motor. Together the three pumps have a capacity of 490,000 gal. per min., against a head of 540 ft. These pumps will deliver water into a storage reservoir, using the surplus current available when there is little demand on the power station. It is intended to install a fourth pump of the same capacity when the plant is extended.

Various reports on the construction of new hydraulic storage reservoirs in Germany have recently been issued. For example, on the Niederwartha plant in Saxony, but the large pumps there are surpassed by those ordered for the Hengstey plant. The pumps at Niederwartha being two 27,000-hp. centrifugals. The plant is intended to operate in conjunction with the Sachisiche Werke to supply the peak loads on the Dresden transmission lines, and insure power in case of breakdown.



More than 1,200 employees of the Commonwealth Edison Company and friends in the power industry attended this dinner to W. L. Abbott, marking his 40 years of service with the company. The celebration was held at the Palmer House, Chicago, Feb. 14

Completing Automatic Power Plant at Alouette, B. C.

With the completion of the new automatic power plant at Alouette the British Columbia Electric Railway Company will add 12,500 hp. to its hydro-electric system on the lower mainland of British Columbia. This new additional power source has necessitated an expenditure of approximately $2,500,000.

Work on the construction of the new Alouette power plant has been in progress since the early part of 1924 and is now practically completed. The construction of the tunnel, erection of the dam and building of the power house have now been finished and the installation of the generating machinery is nearing completion.

Soon to Supply Power

The new plant is about 25 miles east of Vancouver. The nearest point on either roadway or railway was Haney, and the first work to be undertaken by the company after deciding to develop the water power of Alouette Lakes was to establish the necessary transportation communication.

A tunnel has been driven from Alouette Lakes to the Stave River and a dam built to raise the level of the lakes to permit the necessary diversion and to increase the storage capacity.

The new plant will begin supplying power to the lower mainland of British Columbia in a few weeks and will be but a further indication of the confidence which the British Columbia Electric Railway Company has in the future of this province.

Shipping Board Awards Two Diesel Contracts

Contracts for the furnishing of electrical equipment for the Shipping Board freighters "Defiance" and "Triumph," which are to be converted to Diesel drive, have been awarded to the Westinghouse Electric & Manufacturing Company. The conversion of the "Defiance" will take place at the Norfolk Navy Yard. The "Triumph" will be converted at Boston.

The 3,000-hp. steam propelling machinery and steam auxiliaries on the ships will be removed, and 4,000-hp. Diesel-electric propelling machinery with complete electric auxiliaries will be installed.

McIntosh-Seymour Diesels

"The electric form of propulsion was decided upon in preference to a direct drive Diesel engine, largely because of the saving in cost, weight and space in favor of the electric drive where comparatively low propeller revolutions are desired," according to a statement by Westinghouse, issued Feb. 22.

"The vessels will be driven by a 1,500-volt double armature, direct-current, forced-ventilator motor of 4,000 shaft hp. at 60 r.p.m., which is directly connected with the propeller. Power for the propulsion motor will be supplied by four McIntosh-Seymour Diesel engines, directly connected with a 300-kw., 250-r.p.m., 375-volt main generator and 100-kw. 240-volt direct-current auxiliary generator and exciter.

"The Westinghouse variable voltage propulsion control equipment will be installed with dead-front control pedals and arranged for both pilot house and engine room control.

Nevin E. Funk Now Chief Engineer of Philadelphia Electric Company

The appointment of Nevin Elwell Funk as chief engineer of The Philadelphia Electric Company, to succeed the late William C. L. Eglin, was announced

Nevin Elwell Funk

Feb. 17 by William H. Taylor, president of the company. Mr. Funk since Dec. 15, 1926, has been assistant chief engineer.

Designed Boiler Control System

Mr. Funk was born in Bloomsburg, Columbia County, Pa., Nov. 4, 1883. He was graduated from the Lehigh University in 1905 as an electrical engineer. He was subforeman of the New York Central Railroad for a short period after serving as an apprentice in the Westinghouse Electric & Manufacturing Company. After teaching in the electrical school of the Georgia School of Technology, Atlanta for nine months, he entered the employ of the Philadelphia Electric Company in 1907 as sub-assistant foreman in the electrical construction division. Two years later he was made assistant superintendent in charge of the operating, generating and substation system in direct charge of the electrical end of the generating stations and substations.

In 1914 he was made combustion engineer, devoting his efforts to improving the methods of boiler operation, designing a boiler control system and instructing the boiler room forces; and in 1915 he was made assistant to the operating engineer, in direct charge of the load dispatchers, substations and all improvements and efficiency work in the generating stations. Promoted in 1917 to superintendent of the Schuylkill station, which supplied the majority of the current and power for the operation of the munition and shipbuilding plants along the Delaware River during the World War, the same year he became the assistant operating engineer and a year later operating engineer. This latter position he held until 1926, when he was made assistant chief engineer.

Of Many Professional Activities

He is a member of the American Society of Mechanical Engineers, American Institute of Electrical Engineers, National Electric Light Association, American Society for Testing Materials, American Mathematical Society, Franklin Institute, Engineers Club, University Club, Penn Athletic Club and the Lehigh University Club of Philadelphia. He has served as chairman of the Philadelphia Section of the A.S.M.E., the Power Division of the A.S.M.E., the Lubrication Sub-committee of the Prime Movers Committee of the National Electric Light Association, and of the Power Station Betterment subcommittee of the Prime Movers Committee of the N.E.L.A.

Water Tunnel to Grays Harbor Plant Ready in Summer

Plans for a seven-mile tunnel to furnish water to the new plant which the Grays Harbor Pulp & Paper company is building in Hoquiam, Wash., are being drawn up. Field work will be started as soon as details are completed, which will be by the end of this month, and will be finished, so that the water system will be ready when the mill is ready, late in the summer, probably August. When the paper mill was first started, it was expected that the Hoquiam water system could be made adequate for the needs of the paper plant, but it was later decided that this was not feasible.

Barr & Cunningham, engineers of Portland, Ore., have been commissioned for the construction.

Addition to Vancouver Plant

The British Columbia Electric Railway Company has announced its intention of developing an additional 2,000 hp. at its Jordan River plant on Vancouver Island. This is the first addition to the Jordan River plant since 1913 and will increase its capacity from 25,000 to 27,000 horsepower.

British Committee Reports on Steam Nozzle Research

The Steam Nozzle Research Committee, which was established in the United Kingdom in 1914 to investigate the efficiency of steam nozzles and, in particular, the behavior of steam passing through curved forms or nozzle, such as are used in steam turbines, has just issued its fifth report. The committee's first four reports described comprehensive tests on the efficiencies of convergent impulse nozzles and of two sizes of Parsons reaction nozzles.

The fifth report represents the beginning of an entirely new phase in the committee's work, the scope of the research being broadened by considerable additions to the original apparatus, while still further additions are in contemplation. Tests have been made on a nozzle under different conditions of pressure range from those which had previously been used. Instead of exhausting against the back pressure due to the atmosphere, the pressure in the receiver was maintained at approximately 60 lbs. per square inch abs., and the initial pressure was adjusted to give velocities of the steam jet at exit extending up to the velocity of sound in steam. The nozzles tested were convergent impulse nozzles with a nominal angle of 20 degrees. Owing to the larger quantities of steam flowing through a nozzle under the higher pressure range, the height of these nozzles was reduced from 2 in. to 1¼ in. Otherwise they were commercially similar to those previously tested against atmospheric back pressure. The efflux angles of the new nozzles were found to agree with those previously determined, and the same settings in the tester were used. The addition to the apparatus of a gas-fired superheater brought the degree of superheat under control and, in the absence of any other criterion, the initial superheats in the new test were adjusted to correspond with those of the old. This involved the use of higher initial steam temperatures owing to the increased steam pressure.

The degree of accuracy of the new test declined and a considerable time passed before the pressure measurements could be considered to be reliable. Eventually the difficulty was overcome by providing a mercury differential pressure-gauge, working under cool water. This gauge was employed in conjunction with very carefully calibrated test gauges of the Bourdon type. The tests showed no appreciable difference between the two pressure ranges.

Johannesburg Power Station Finally Sanctioned

After a number of delays, due to the opposition of the South African Electricity Supply Commission, which took the view that the supply should be obtained from one of the new superpower stations, Johannesburg Municipality has at last received the hitherto withheld sanction of the Provincial Council to a loan of $2,550,000 to enable it to carry out its original scheme to erect its own new power station.

Anticipating this development, the council has already spent $1,000,000 on the installation of an additional 10,000 kw. generator, and the decision of the Provincial Council now enables the council to continue to generate and supply its own power, instead of linking up with the chain of power stations being provided by the Electricity Supply Commission, primarily for the supply of power to the mines.

Lincoln Electric Reorganizes Welding School

The Lincoln Electric Company, Cleveland, manufacturing "Stable-Arc" welders, has recently reorganized and re-equipped a school of welding in their shop. Its purpose is the training of electric arc welders, for which no tuition or fees are charged. The course in the Lincoln Electric Welding School is a thirty day one, and is given in twelve lessons. Pupils work under the direction of a trained instructor who teaches them both as a class and as individuals.

A.S.H.V.E. Committees Are Appointed

A. C. Willard, president of the American Society of Heating and Ventilating Engineers, has announced the appointment of the following committees of the council of that organization:

Executive, Thornton Lewis, chairman, J. F. McIntire, H. Lee Moore; membership, Roswell Farnham, chairman, W. E. Gillham, C. V. Haynes; finance, W. T. Jones, chairman, J. F. McIntire, Thornton Lewis, and publication, L. A. Harding, chairman, N. W. Downes, and H. H. Angus.

Two special committees to handle the program and arrangements for the next meeting of the Society are: program, F. B. Rowley, chairman, John Howatt, W. H. Carrier; and semi-annual meeting, E. B. Langenberg, chairman, F. Paul Anderson, and J. J. Kissick.

Annual Banquet of Midwest Power Conference at Stevens Hotel, Chicago, Feb. 15—1,100 at Table

Skilled Fuel Utilization Gets Gain in Electricity Output

Electricity produced by the use of fuel made a rapid gain during 1927, the Geological Survey reported Feb. 21 in an analysis of the annual production of electricity and consumption of fuels by public utility power plants.

Electricity produced by water power increased but 1.6 per cent, whereas electricity produced by the use of fuels increased 5½ per cent, it was stated.

This change, it was noted, resulted from the improvement in the average utilization of fuels that has been brought about by improvements in plant design and operation. The statement in full text follows:

Preliminary figures of the total annual production of electricity by public utility power plants in the United States indicate an output of 79,724,000,000 kw.-hr. in 1927, an increase of 8 per cent over the output for 1926. Of this quantity 37 per cent was produced by the use of water power, an increase of 1.6 per cent over the proportion for 1926. In kilowatt-hours the electricity produced by the use of fuel increased about 5½ per cent, and the electricity produced by water power increased about 13 per cent. It would have required about 27,000,000 tons of coal to generate the electricity which was produced by the use of water power.

Power Plant Improvements Responsible

The improvement in the average utilization of fuels that has been brought about by improvements in plant design and operation during the last few years continued in 1927. The operators of public utility power plants performed the remarkable feat of generating about 2½ billion more kilowatt-hours of electricity by the use of fuel in 1927 than in 1926 by the consumption of about 150,000 tons of fuel less than was used in 1926.

From 1919 to 1927 the average quantity of coal required to produce a kilowatt-hour of electricity has decreased from about 3.2 to about 1.8 lb. This is a notable performance, not only in the total amount of the reduction during the eight-year period—1.4 lb., or a reduction nearly as great as the present average rate of consumption per kilowatt-hour—but especially in the continuation of the improvement during recent years, when the limit of achievement in utilization of fuel under present conditions of generation of electricity has almost been reached.

2 Ounces per Kilowatt-Hour Saved

The reduction in the average fuel rate from 1926 to 1927 was about 0.12 lb., or almost 2 oz., per kilowatt-hour generated. With coal costing $4 a ton, it would require the savings on the generation of about 4,000 kw.-hr. of electricity to amount to one dollar in fuel. The total consumption of electricity by 10 average domestic customers in 1927 about equaled 4,000 kw.-hr. The apparently insignificant saving of 0.12 lb. of coal per kilowatt-hour amounted to about 3,000,000 tons of coal for the year, or, at $4 a ton, $12,000,000.

Personal Mention

A. Duperron, engineer of the Quebec Streams Commission, has been appointed chief engineer of the Montreal Tramways Commission.

Ross M. Carmichael, has resigned his position as designing engineer, Hydro-Electric Power Commission of Ontario, to join the engineering staff of the Aluminum Company of Canada, at Arvida, Que.

William Anderson, power apparatus specialist with the Northern Electric Company, Ltd., Calgary, Alta., has been appointed to the position of sales engineer with the Canadian Westinghouse Company, Ltd.

A. J. Wiley, consulting engineer on the Owyhee dam project in eastern Oregon and western Idaho, has returned to this country from a trip to India, where he was in consultation on matters for the British government concerning power development and irrigation.

W. A. Burns, representative in Portland, Oregon, for many years for the Atlas Imperial Diesel Engine Company, maker of Diesel engines in Oakland, California, has been promoted to a position with the home plant, and has left to take up his duties in the southern city.

P. O. Crawford of the California-Oregon Power Company, gave an illustrated lecture on his company's new Rogue River power plant, at a meeting of the Oregon Technical council held the evening of Feb. 17, in the auditorium of the new Public Service building in Portland.

R. W. Lincoln, who has been in the employ of the water works department and in other capacity for the city of Portland, Oregon, has left for Vernon, British Columbia, to become chief engineer of the West Canadian Hydro-Electric Company, Ltd., of that place. He was formerly a member of the Stiger Lincoln engineering firm.

H. H. Schoolfield, chief engineer of the Pacific Power & Light Company, Portland, Ore., was elected president of the Oregon Technical Council at the annual meeting held in February. He was formerly vice-president of the executive committee. A. H. Wethy was chosen vice-president and C. N. Bjornvall was elected secretary-treasurer. This body includes members from the A.S.M.E., A.I.E.E., N.E.L.A., and other societies.

Society Affairs

A.S.M.E.—Tri-Cities, Feb. 23, 8:30 p.m. Subject: "Standardization as a Policy of Management, Economical Production Requiries Standardization," by Mr. M. E. Steczynski, Fairbanks, Morse & Company, Beloit, Wis.

A.S.M.E. — Schenectady, March 1, Twentieth Century Lunch, Schenectady, N. Y., at 5:45 p.m.; "Recent Developments in Atomic Theory by Dr. A. W. Hull, General Electric Company.

A.S.M.E.—Cleveland—Cleveland Hotel, March 5, dinner at 6 p.m. This will be an informal dinner for the President of the A.S.M.E. Subject: "Some Principles of Success," by Alex Dow, president of the American Society of Mechanical Engineers.

Affiliated Technical Societies of Boston—Engineers' luncheon, March 12; speaker to be announced hereafter and in March bulletin of Affiliated Technical Societies of Boston.

A.S.M.E.—Philadelphia — Engineers' Club of Philadelphia, 1317 Spruce St., Philadelphia, March 27; dinner at 6 p.m. Meeting at 8 p.m. Subjects: "Progress in the Burning of Coal," by Prof. A. G. Christie, professor of mechanical engineering, Johns Hopkins University, Baltimore, Md. "Special and Anti-Knock Fuels," by Dr. Graham Edgar, director of research, Ethyl Gasoline Corporation, New York; "Recent Developments in Low Temperature Carbonization," by Col. H. D. Savage, president of the Dry Quenching Equipment Corporation, New York.

A.S.M.E.—Engineers' Club of San Francisco, March 29, 7 p.m. Subject: "The Design of Steam Electric Generating Stations," by R. C. Powell, assistant chief of division of electric distribution and steam, Pacific Gas & Electric Company, of San Francisco.

American Water Works Association, Indiana Section meeting will be held at Purdue University, Lafayette, Ind., March 15 and 16; Cecil K. Calvert, 1902 N. New Jersey St., Indianapolis, Indiana, secretary.

American Water Works Association. The next meeting of the Canadian Section will be held at London, Ontario, Canada, March 7-9, 1928. A. U. Sanderson, Filtration Plant, Centre Island, Toronto, Ont., secretary.

Business Notes

The Electric Machinery Manufacturing Company announces the appointment of L. Brandenburger, 149-151 West Second South, Salt Lake City, Utah, as Salt Lake City representative, and R. R. Poppleton, Inc., 35 First St.,

Portland, Ore. and 2963 First Ave. South, Seattle, Wash. as Portland and Seattle representative.

THE CLIMAX ENGINEERING COMPANY has announced that Lorimer Dunlevy has resigned his position as sales manager, effective March 15, to take on new duties as general sales manager for the O. E. Szekely Company, Holland, Mich., makers of commercial airplane engines and other products now in process of design.

THE UNITED CONVEYOR CORPORATION has purchased from Conveyors Corporation of America the good will and all patterns, patents, designs and manufacturing rights for the American steam jet ash conveyor, the American cast-iron storage tank and American air-tight doors, and the steam-jet ash conveyor business of its precedessors, American Steam Conveyor Corporation, Green Engineering Company, Girtanner-Daviess Company and the Griffin Engineering Company.

THE FRICK COMPANY, Waynesboro, Pa., has purchased the business, patents, designs and manufacturing equipment of the Simplex Ice & Manufacturing Company, Dallas, Tex. The Frick Company hereafter will manufacture the Simplex Ice Scoring machine and the Simplex Ice Vendor at Waynesboro. B. H. Giles, formerly secretary of the Simplex Ice & Manufacturing Company, has become associated with the Frick Company and will direct the sale and distribution of the Simplex products. He will make his headquarters at both the Dallas and Waynesboro offices of the Frick Company.

Coming Conventions

American Institute of Electrical Engineers, St. Louis Regional Meeting, District No. 7, March 7-9; Baltimore Regional Meeting, District No. 2, April 17-19; New Haven Regional Meeting, Northeastern District, No. 1, in May; Summer Convention, in Denver, June 25-29.

American Institute of Refrigeration, Washington, D. C., May 10-11.

American Society of Heating and Ventilating Engineers, Summer meeting at West Baden Springs Hotel, West Baden, Ind., June 26-29; A. V. Hutchinson, secretary, 29 West 39th St., New York City.

American Society of Mechanical Engineers, spring meeting in Pittsburgh, May 14-17; Calvin Rice, secretary, 29 West 39th St., New York City.

American Society for Testing Materials, Atlantic City, June 25-29.

American Water Works Association. Annual meeting, Hotel Fairmont, San Francisco, June 11-16; W. M. Niesley, 170 Broadway, New York City.

Association of Iron and Steel Electrical Engineers, annual convention and Iron and Steel Exposition at Hotel Stevens, Chicago, June 25-29.

National Association of Power Engineers, annual convention at Detroit, Sept. 11-15, and concurrently National Exhibitors' Assn. exhibit; Fred Raven, 417 South Dearborn St., Chicago.

National Board of Boiler and Pressure Vessel Inspectors, meeting at Erie, Pa., June 18-20.

National Electric Light Association, Convention and exhibition, Atlantic City, N. J., June 4-8; A. Jackson Marshall, secretary, 420 Lexington Ave., New York City.

National District Heating Association, annual meeting at Ambassador Hotel, Atlantic City, June 12-15; D. J. Gaskill, sec., 112 West 4th St., Greenville, Ohio.

Stoker Manufacturers Association, fall meeting at Greenbrier Hotel, White Sulphur Springs, W. Va., Oct. 22-24.

Universal Craftsmen Council of Engineers, Newark, N. J., Aug. 7-10.

Second Bituminous Coal Conference will be held at Pittsburgh, Nov. 19-22.

Trade Catalogs

RECORDING INSTRUMENTS—The Bristol Company has issued a new Catalog No. 1502, describing Bristol's recording wattmeters and recording frequency meters.

BEARINGS—The Rollway Bearing Company has issued recently a new catalog 4-A on its Wide Series and Utility type of bearings and also a number of bulletins as follows: Bulletin No. 53—Self-Aligning Pillow Blocks equipped with Rollway Adapter Type Bearings to fit Standard Commercial Shafting. Bulletin No. 54—Various Precision types of Rollway Radial Bearings. Bulletin No. 55—Self-Aligning Pillow Blocks equipped with Standard Rollway Bearings. Bulletin No. 56—Large Rollway Bearings in the recently adopted International sizes.

SCREW CONVEYORS—As the aggregate of more than 50 years' experience in the manufacture of screw conveyors, H. W. Caldwell & Son Co. has just issued an 85-page book devoted entirely to screw conveyor, fittings and accessories. The new book covers both the Caldwell helicoid and sectional flight types. The data, in addition to being very complete, has been arranged in a manner to offer convenience to those interested in the subject. A copy may be had by writing to H. W. Caldwell & Son Co., Western Avenue, 17th & 18th Sts., Chicago, and asking for Book No. 989.

SILENT CHAIN DRIVES. The Morse Chain Co. Ithaca, N. Y., has recently issued a 156-page leather bound handbook on silent chain drives that treats the subject of silent chain power transmission, and facilitates the selection and design of the proper drive for any given requirements. Complete instructions on how to design silent chain drives are given together with a discussion of the various factors that must be considered. This is followed by an example of an actual design. A comprehensive list of typical drives is given to assist engineers in estimating cost of such equipment. This list also gives the pitch, width and number of teeth which may be used on similar drives. There are tables giving sprocket diameters, sprocket list prices, chain list prices, standard hub lengths, bores and other data that are useful in the successful design of chain drives. Complete instructions are given as to the installations, care and operation of the drives.

Fuel Prices

COAL

The following table shows the trend of the spot steam market in various coals, f.o.b. mines; mine run, except Pittsburgh gas slack:

Bituminous (Net Tons)	Market Quoting	
Navy Standard	New York	$2.50@$2.65
Kanawha	Columbus	1.25@ 1.60
Smokeless	Cincinnati	2.00@ 2.25
Smokeless	Chicago	1.85@ 2.25
S. E. Kentucky	Chicago	1.40@ 1.60
Steam	Pittsburgh	1.75@ 1.85
Gas Slack	Pittsburgh	1.00@ 1.25
Big Seam	Birmingham	1.50@ 2.00
Anthracite (Gross Tons)		
Buckwheat	New York	$3.00@$3.25
Birdseye	New York	1.60

FUEL OIL

New York—Feb. 23, light oil tank-car lots, 28@34 deg., Baumé, 4½@5c. per gal.; 36@40 deg., 5½@6c. per gal., f.o.b. Bayonne, N. J.

St. Louis—Feb. 16, tank-car lots, f.o.b. St. Louis, 24@26 deg., $1.60 per bbl.; 26@28 deg., $1.65 per bbl.; 28@30 deg., $1.70 per bbl.; 30@32 deg., $1.75 per bbl.; 32@36 deg., gas oil, 4.276c. per gal.; 38@40 deg., 5.23c. per gal.

Pittsburgh—Jan. 12, f.o.b. local refinery, 30@34 deg., fuel oil, 4½c. per gal.; 36@40 deg., 4¾c. per gal.

Philadelphia—Feb. 15, 26@30 deg., $2.00@$2.06 per bbl.; 13@19 deg., $1.26 @$1.32 per bbl.; 22 plus, $1.58@$1.64 per bbl.; 27@30 deg., $2.10@$2.16 per bbl.

Cincinnati—Feb. 21, tank-car lots, f.o.b. local refinery, 24@26 deg. Baumé, 4.9c. per gal.; 26@30 deg., 5.15c. per gal.; 30@32 deg., 5½c. per gal.

Chicago—Feb. 18, tank-car lots, f.o.b. Oklahoma, freight to Chicago, 90c. per bbl.; 22@26 deg., 85@90c. per bbl.; 26@30 deg., 90@95c. per bbl.; 30@32 deg., $1.10@$1.15 per bbl.

Boston—Feb. 13, tank-car lots, f.o.b. 12@14 deg. Baumé, 4¼c. per gal.; 28@ 32 deg., 5¾c. per gal.

Dallas—Feb. 18, f.o.b. local refinery, 26@30 deg., $1.40 per bbl.

NEW PLANT CONSTRUCTION

Calif., Grenada—Big Springs Irrigation Dist., V. Bovo, Secy., will receive bids until Mar. 5 for waterworks improvements including two pumping plants, etc.

Calif., Huntington Park—S. Karpen & Bros., awarded contract for an 80 x 200 ft. furniture factory including loading platforms, etc. at 925 Irvington Ave. to E. L. Peck, Inc., 721 H. W. Hellman Bldg., Los Angeles. Estimated cost $200,000.

Calif., Oakland—Income Properties Co. of California, 436 14th St., is having plans prepared for the construction of a theatre on 17th St. Estimated cost $1,000,000. Weeks and Day, Financial Center Bldg., are architects.

Calif., Richmond—Pittsburgh Plate Glass Co., Frick Bldg., plans the construction of a glass plant here. Estimated cost $5,000,000.

Fla., Jacksonville—American Fruit Dispatch, Florida Theatre Bldg., plans the construction of an assembling and cold storage plant.

Conn., Greenwich—Fairfield House, D. M. Oltarsh, 36 West 44th St., New York, N. Y., plans the construction of a theatre on West Putnam Ave. here. Estimated cost $2,000,000.

Del., Wilmington — National Lumber & Creosoting Co., 312 Railway Exchange Bldg., Kansas City, Mo., plans the construction of first unit of plant capable of handling 6,000 acres of lumber per year on 50 acre site here. Estimated cost $1,000,000.

D. C., Washington—City Central Corp., R. A. Nordbloom, Pres., 30 Federal St., Boston, Mass., awarded contract for a hotel, auditorium and convention hall at 15th and H Sts. N.W., to James A. Stewart & Co., 1420 New York Ave. N.W., also plans a hotel at 10th and D Sts. N. W. here. Estimated cost $3,000,000 and $800,000 respectively. Milburn-Heister Co., Hill Bldg., is architect.

D. C., Washington—D. L. Stern, will build an apartment building at 4615 Connecticut Ave. N.W. Estimated cost $600,000.

Ga., Sandersville—Georgia Portland Cement Corp., H. W. Neill, Secy. and Treas., awarded contract for a cement plant to H. K. Ferguson Co., Hanna Bldg., Cleveland, O. Estimated cost $2,000,000.

Ill., Chicago—Holabird & Roche, 104 South Michigan Ave., Archts., will receive bids until Mar. 12 for a 23 story printing plant and office building including elevators, etc. at Canal and Madison Sts. and Washington Blvd. and River for Chicago Daily News, 15 North Wells St. Estimated cost $10,000,000.

Ill., Chicago—Holabird & Roche, 104 South Michigan Ave., Archts., will receive bids until Mar. 2 for a 22 story apartment building at Sheridan Rd., Belmont and Melrose Sts. for A. W. Swayne, 410 North Michigan Ave. Estimated cost $2,000,000.

Ill., Chicago—S. H. Newman & Associates, 310 South Michigan Ave., is having plans prepared for a 13 story apartment building at 26 East Elm St. Estimated cost $1,200,000. T. H. Bishop & Son, 35 South Dearborn St., are architects.

Ill., Chicago — Roneberg & Pierce, 10 South La Salle St., Archts., will soon receive bids for a 5 or 7 story apartment building including central refrigeration plant, vapor heating system, elevators, etc., at 924 Eastwood Ave., for S. N. Nielsen, c/o architects. Estimated cost $450,000.

Ill., Chicago—Michigan Shore Club, 612 North Michigan Ave., is having sketches made for a 26 story club building at Rosemont Ave. and Sheridan Rd. Estimated cost $1,500,000. F. W. Hodgdon, 176 West Adams St., is architect.

Ill., Kenilworth—Village awarded contract for the construction of a filter plant and pumping station to Bierd, Lydon & Grandpre, 228 North La Salle St. Estimated cost $78,000.

Ill., Moline—City plans an election to vote $350,000 bonds for the construction of a river barge terminal, including loading and unloading platforms, etc. R. M. Benell, City Hall, is engineer.

Ind., Indianapolis—L. S. Ayres Co., 1 West Washington St., is receiving bids for an 8 story department store including steam heating system, elevators, etc. at Meridian and Pearl Sts. Estimated cost $1,500,000. Vonnegut-Bohn, Mueller, 610 Indiana Trust Bldg., are architects.

Ind., Muncie—Indiana General Service Co., W. C. Driscoll, Supt., is having plans prepared for an electric sub-station. Estimated cost $500,000.

Ia., Des Moines—Iowa Packing Co., East 18th and Maury Sts., awarded contract for the construction of a 42 x 54 ft. boiler house to W. A. Lewis, 1507 46th St.

Ia., Decorah—Interstate Power Co., M. E. Hall, Dist. Mgr., Dubuque, plans the construction of a new power plant; improvements to dam, 12 mi. from here, and new dam about 18 mi. northeast of Decorah at Hanover dam. Engineering Corp. of Utilities Power & Light Corp., 327 South La Salle St., Chicago, Ill., is engineer. Work will be done by owners' forces.

Ky., Louisville—Louisville National Bank & Trust Co., will build a 4 story bank and office building including steam heating system, etc. Estimated cost $500,000. St. Louis Bank Building & Equipment Co., 900 Sidney St., St. Louis, Mo., is architect. Nevin, Wischmeyer & Morgan, Starks Bldg., Louisville, are associate architects. Work will be done by separate contracts.

La., New Orleans—American Bank, Carondelet St., plans the construction of a 7 story bank and office building including steam heating and ventilation systems, boilers, elevators, etc. Estimated cost $1,000,000. M. H. Goldstein, Hibernia Bank Bldg., is architect.

Md., Guilford (mail Jessups)—City of Baltimore, is having plans prepared for the construction of a pumping station here. E. G. Rost, is Water Engineer.

Mass., Allston (Boston P. O.)—Albany Carpet Cleaning Co., 18 Penniman Rd., awarded contract for addition to factory and boiler house to J. F. Griffin Co., 250 Stuart St., Boston.

Mass., Barnstable—Town plans the construction of a sewage disposal system including electric pumping station, etc. Whitman & Howard, 200 Devonshire St., Boston, are engineers.

Mass., Boston—Dept. of Public Buildings, will soon receive bids for the construction of a power and heating plant for jail on Charles St. Estimated cost $100,000.

Mass., Bourne—Town plans the construction of a new waterworks system including wells, pumping station, mains, etc. Estimated cost $500,000. Metcalf & Eddy, Statler Bldg., Boston, are engineers.

Mass., Brockton—The Brockton Ice & Coal Co., 426 Main St., is having plans prepared for an ice manufacturing plant on Lawrence St. Funk & Wilcox, 26 Pemberton Sq., Boston, are architects. York Ice Machinery Corp., 200 Causeway St., Boston, is engineer.

Mass., Lynn—North Shore Ice Delivery Co., 46 Lake Ave., is having preliminary plans prepared for an ice manufacturing plant on Boston Rd. Estimated cost $40,000. Funk & Wilcox, 26 Pemberton Sq., Boston, are architects. York Ice Machinery Co., 200 Causeway St., Boston, is engineer.

Mich., Grand Rapids—City plans an election to vote $1,800,000 for waterworks improvements including additional space for alum and lime feeding devices, alum and recarbonating plant, alum and lime storage, equipment for five 2 m.g. filter units, increasing filter plant capacity and constructing sub-station at Ramsey Park, etc. R. E. Harrison, City Hall, is consulting engineer.

Mich., Jackson—Sparks-Withington Co., is having plans prepared for the construction of a 60 x 260 ft. radio factory and 30 x 40 ft. boiler house. Lockwood Greene & Co., Hanna Bldg., Cleveland, O., are engineers.

Mich., Marshall—Rich Steel Products Co., C. C. Rich, Battle Creek, awarded contract for a 185 x 295 ft. factory and 40 x 60 ft. boiler house to Reniger Construction Co., 127 North Cedar St., Lansing. Estimated cost $90,000.

Minn., Minneapolis—C. J. Bard, 838 Builders Exchange Bldg., Archt., will receive bids until Mar. 8 for a 26 story medical building including steam heatng system, elevators, etc. at 10th St. and 3rd Ave. S., for Physicians, Dentists & Hospital Building Co. Inc., B. A. Gingold, Pres., 324 Syndicate Bldg. Estimated cost $2,200,000.

Miss., Belzoni—T. B. Craft, plans the construction of a cold storage plant for meats and produce. Estimated cost $40,000.

Miss., Hattiesburg—R. B. McLeod, is having plans prepared for a 9 story hotel including steam heating and ventilation systems, boilers, elevators, etc. at Pine and Forrest Sts. Estimated cost $600,000. Jones, Roessle & Olschner, Maison Blanche Bldg., New Orleans, La., are architects.

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Mo., Clayton—Owner, c/o Gantz & Early, Arcade Bldg., St. Louis, is having preliminary plans prepared for two 4 story and two nine story apartment buildings including steam heating system, etc. on Hadley Rd. here. Estimated total cost $2,500,000.

Mo., Trenton—City plans the construction of a light and power plant. Burns & McDonnell Engineering Co., 401 Interstate Bldg., Kansas City, Mo., is engineer.

N. J., Newark—M. Tzeses, 36 Bock Ave., is receiving bids for a 12 story apartment building including steam heating and refrigeration systems, boilers, elevators, etc. on Johnson Ave. Estimated cost $750,000. H. F. Clark, 38 Clinton St., is architect.

N. J., Radburn (Paterson P. O.)—City Housing Corp., A. M. Bing, Pres., 587 5th Ave., New York, N. Y., is having sketches made for the construction of an apartment, school, etc., including steam heating system, etc., here. Estimated cost $1,000,000. C. S. Stein, W. Wright, R. D. Kohn and F. Ackerman, 56 West 45th St., New York, N. Y., are associate architects.

N. J., Red Bank—Red Bank Hotel Co., A. Williams, Salz Bldg., is having revised plans prepared for a 9 story hotel including steam heating system, boilers, elevators, etc. at Riverside Dr. Estimated cost $650,000. N. Harris, 20 Branford Pl., Newark, is architect. Former bids rejected.

N. Y., Brooklyn—Dept. of Welfare, B. S. Coler, Comr., Municipal Bldg., New York, plans the construction of a 10 story hospital on Clarkson Ave. here. Estimated cost $5,000,000. Ward, Kerrigan & Magnuson, 420 Lexington Ave., are architects.

N. Y., Brooklyn—Kings County Real Estate Corp., J. F. James, Pres., 193 Montague St., had plans prepared for an 11 story hotel at Court and State Sts. Estimated cost $1,000,000. Slee & Bryson, 160 Montague St., are architects.

N. Y., New York—Baumgarten Bros., 551 5th Ave., is having plans prepared for a 16 story apartment building at 68-74 East 96th St. Estimated cost $1,000,000. Rosario Candella, 578 Madison Ave., is architect.

N. Y., New York—Five Hundred Thirty-Ninth Corp., F. S. Bancroft, Pres., c/o Pease & Elliman, 660 Madison Ave., awarded contract for a 55 story office and stores building at Madison Ave. and 41st to 42nd Sts., to Dwight P. Robinson Co., Inc., 125 East 46th St. Estimated cost approximately $23,000,000.

N. Y., New York—Jewish Memorial Hospital, Dyckman St. and Bolton Rd., plans the construction of a hospital and nurses home at Broadway and 196th St. Estimated cost $1,500,000. Architect not selected.

N. Y., New York—Linen Thread Co., 200 Hudson St., J. Bornstein & Sons Inc., 116 Lexington Ave., awarded contract for a 5 story office and stores building at 33 Fulton St. to J. Bornstein & Sons Inc., 116 Lexington Ave. Estimated cost $800,000.

N. Y., New York—New York Central Hotel Corp., J. Manger, Pres., 261 West 43rd St., had plans prepared for a 15 story hotel at 144 East 43rd St. Estimated cost $1,350,000. Lawrence & John Scacchetti, 1775 Broadway, are architects.

N. Y., New York—Park Lexington Corp., C. S. Winters, Pres., c/o Schultze & Weaver, 17 East 49th St., Archts., had plans prepared for a 25 story hotel at 499-515 Lexington Ave. Estimated cost $2,800,000.

N. Y., New York—B. Pollack, 570 7th Ave. and S. B. Pollack, 44 Wall St., awarded contract for a 16 story loft building at 330-340 West 38th St., to Magoba Construction Co., 271 Madison Ave. Estimated cost $1,200,000.

N. Y., New York—Sixty Eight East 96th St. Corp., M. Baumgarten, Pres., 551 5th Ave., had plans prepared for a 16 story apartment building at 68 East 96th St. Estimated cost $600,000. R. Candela, 578 Madison Ave., is architect.

N. C., Hickory—City awarded contract for the construction of a raw water pumping station, etc. to J. B. McCrary Co., Citizens and Savings Bank Bldg., Atlanta, Ga. Estimated cost $66,283.

N. C., Murphy — North Carolina-Tennessee Power Co. is having surveys made for a hydro-electric development including six to eight dams, etc., on Hiawassee River.

N. C., Sanford—Carolina Power & Light Co., P. A. Tillery, Gen. Mgr., 5 West Hargett St., Raleigh, plans the construction of a new sub-station here. Estimated cost $75,000 to $100,000.

O., Cleveland—Handel-Weinstein Co., M. Weinstein, Pres., 2702 East 51st St., is receiving bids for the construction of a packing house. Estimated cost $40,000. A. A. Soffen, 408 Engineers Bldg., is architect.

O., Cleveland—The Lehigh Portland Cement Co., c/o F. C. Fisk, Industrial Engr., Allentown, Pa., plans the construction of a cement plant along the Cuyahoga River, here. Estimated cost $1,000,000.

O., Columbus—Bd. of Trustees, Ohio State University, C. E. Steeb, Secy., awarded contract for a 112 x 120 ft. addition to power house to Van Gundy Beck & Co., Lancaster. Estimated cost $127,413.

O., Elyria—Steel & Tubes Inc., H. B. Wick, Pres., 224 East 131st St., Cleveland, plans the construction of a hot strip mill here. Estimated cost $1,500,000. Private plans.

Okla., Vici—E. W. Baker & Co., Perrine Bldg., Oklahoma City, plans the construction of a 200 hp. Diesel electric light plant here, also 50 mi. 13,200 v. transmission line to Camargo, Seiling and Taloga. Estimated cost $75,000. Private plans.

Okla., Vinita—City plans to rebuild power plant and pumping station, also installation of Diesel engines. Estimated cost $30,000. A. C. Moore, Joplni, Mo., is engineer.

Pa., Philadelphia—Stenton Corp., c/o Webber & Wurster, 1530 Locust St., plans the construction of a 26 story apartment building at Broad and Spruce Sts. Estimated cost $2,225,000.

Pa., Pittsburgh — Graham, Anderson, Probst & White, 80 East Jackson Blvd., Chicago, Ill., Archts., will receive bids until Feb. 29 for a 35 story office building on Grant St. for The Koppers Co., Union Trust Bldg. Estimated cost $5,000,000.

Pa., Pittsburgh—National Biscuit Co., 85 9th Ave., New York, N. Y., awarded contract for addition to bakery and power house here, to Lundoff-Bicknell Co., B. F. Keith Bldg., Cleveland, O. Estimated cost $375,000.

Pa., Pittsburgh—Pittsburgh Hotels Corp., c/o William Penn Hotel, awarded contract for an 18 story addition to hotel at Grant, Olive and William Penn Way to W. T. Grange Construction Co., Keenan Bldg. Estimated cost $4,000,000.

R. I., Providence—J. Conn., c/o Conn Olympia Theatre, is having preliminary plans prepared for the construction of a hotel, office and stores building at Broad, Chestnut and Cliverick Sts. Estimated cost $1,000,000. T. J. H. Pierce Inc., 30 Allens Ave., is architect.

Tex., Alpine—City plans an election soon to vote $40,000 bonds for waterworks improvements including pumping equipment, mains, etc. H. G. Armistead, El Paso, is engineer.

Tex., Beaumont—E. G. Edson, c/o Edson Realty Co., will receive bids about Mar. 1 for a 14 story hotel including steam heating, refrigeration and ventilation systems, boilers, elevators, etc. at Pearl and Liberty Sts. Estimated cost $1,500,000. Hedrick & Gottlieb, 2008 Post Dispatch Bldg., Houston, are architects.

Tex., Laredo—H. B. O'Keefe plans developing 2,500 acres of land for irrigation project; several small dams will be constructed on Becerro and Napalosa Creeks, 12 mi. south of Laredo, along the Rio Grande River, and pumping plant will be installed. Estimated cost $75,000. Private plans.

Tex., Luling—Central Power & Light Co., Frost Bldg., San Antonio, is receiving bids for an ice plant here. Estimated cost $45,000. J. M. Marriott, Frost Bldg., San Antonio, is architect.

Tex., McCamey—Pecos Valley Power & Light Co. awarded contract for a 6,000 kw. addition to power plant to Bickel Contracting Co., 1016 Baltimore Ave., Kansas City, Mo. Estimated cost $150,000.

Tex., Snyder—City plans the construction of a municipal light and power plant. Estimated cost $35,000.

Tex., Texas City—Texas Gulf Power Co., Fort Worth, will soon receive bids for the construction of a power plant, 8,000 hp. capacity here. Estimated cost $300,000. Private plans.

Wash., Seattle—Western Cold Storage Co., Wenatchee, plans the construction of a power, refrigeration and cold storage plant. Estimated cost $1,500,000.

W. Va., Charleston—Community Hotel, c/o W. L. Stoddart, 50 East 41st St., New York, N. Y., Archt., will soon award contract for an 8 story hotel and stores building including steam heating system, boilers, elevators, etc. at Capitol and Washington Sts. Estimated cost $500,000.

W. Va., Parkersburg—Dept. of Water & Sewers, will receive bids until March 13 for the construction of a clear water reservoir, high pumping station, etc.

Wis., Milwaukee—Rosman & Wierdsma, 490 Broadway, Archts., are receiving bids for an 8 story hotel including steam heating and refrigeration systems, elevators, etc. on Juneau St. for East End Manor Hotel Co. Estimated cost $700,000.

Equipment Wanted

Air Compressors—L. V. Guertin & Co., 112 Lincoln St., Worcester, Mass., plans to purchase air compressors.

Boiler—Golden State Milk Products Co., Oakdale, Calif., plans the installation of a 200 hp. steam boiler for proposed addition to creamery. Estimated cost $40,000.

Elevating and Conveying Equipment — Dominion Coal & Wood Co., 2605 Danforth Ave., Toronto, Ont., plans to purchase electric power elevating and conveying equipment for coal pockets. Estimated cost $40,000.

Engines—Borderland Utilities Co., c/o S. C. Johnson, Pres., Ft. Stockton, Tex., plans to purchase two 250 to 320 hp. engines for proposed light and power plants at Marathon, Balmorhea and Blackwell. Estimated total cost $50,000.

Heating and Ventilating Units—New Zealand Government Railways, Wellington, N. Z., will receive bids until June 25 for four heating and ventilating units, etc.

Ice Manufacturing Equipment—M. and M. Brown, owners of Mason Brown Ice & Coal Co., 3442 Cliff Rd., Birmingham, Ala., plans to purchase ice manufacturing equipment, electric motors, etc. for proposed ice plant at Decatur, Ala.

Oil Burning Equipment — Mississippi River Commission, 423 Custom House, St. Louis, Mo., will receive bids until Mar. 6 for oil burning equipment for externally fired boilers.

Power Plant Equipment—Dept. of Public Works, Bureau of Water, Pittsburgh, Pa., plans to purchase a steam turbine driven generator, steam power plant equipment and appurtenances for Ross Pumping Station.

Pumps—City of Royal Oak, Mich., plans to purchase centrifugal pumps, etc., for proposed waterworks improvements.

Pumps—Oklahoma Gas & Electric Co., Insurance Bldg., Oklahoma City, plans to purchase 1000 hp. motor driven pumps for proposed electrically driven oil pumping station for Shell Pipe Line Co. at Lexington, Okla. Estimated cost $50,000.

Pumps, Etc.—City Comrs., City Hall, Monroe, La., will receive bids until Mar. 14 for one 3100, two 4200 and one 10,000 g.p.m. motor driven centrifugal pumps, switchboard, etc. for proposed waterworks improvements.

Pumps, etc.—West Texas Utilities Co., Abilene, Tex., will receive bids until Mar. 1 for motor driven centrifugal pumps, etc., for proposed filter plant and pumping station at San Angelo, Tex.

Pumps, Water Heater, Generator, Etc.—Mayor and City Council, City Hall, Baltimore, Md., will receive bids until Feb. 29 for auxiliary pumping and boiler feed equipment including two 3000 g.p.m. turbo-driven centrifugal pumps, two boiler feed pumps, feed water heater, 35 kw. turbo generator, etc. at Eastern Ave. Pumping Station, San. Cont. 247.

Pumping Equipment—City of Columbia, Ill., will soon receive bids for pumping equipment, etc. for proposed waterworks improvements. Estimated cost $75,000.

Turbine, Generator, etc.—Dept. of Public Works, Supplies and Tenders Board, Wellington, N. Z., will receive bids until May 29 for one turbine complete with governor, set of spare parts and tools, one generator complete with spare parts, one bearing shell (two halves) for each type of bearing, one set of temperature indicator coils, lead and indicator complete for Lake Coloridge electric power scheme.